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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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ON FUNDAMENTAL PROBLEMS OF CYBERNETICS

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 6, Nov-Dec 85 (manuscript received 15 Apr 85) pp 3-9

[Article by V. K. Kabulov, Uzbek Cybernetics Association of Science and Industry, UzSSR Academy of Sciences]

[Text] Cybernetics was formed as the science of optimal control of large systems as a result of information acquisition, transfer and processing. It is customary to assume that a large system consists of subsystems and that it too is a subsystem of a more comprehensive system, the external environment. Matter, energy and information are continuously exchanged between various parts of a large system and the environment. In cybernetics, special attention is paid to the information aspects of large system functioning.

Each large system functions in a space and time according to the laws inherent to it. Consequently, any control is built on the base of the laws of the functioning of an object. In the process, the optimal strategy of control which supports achieving certain goals in the process of the functioning of the object is selected.

Large systems are studied in the process of modeling, i.e. construction of idealized forms of real systems developed with regard to the properties of an object. The properties and parameters of a large system are described by using special languages.

In practice, one large system (man, collective) emerges as the controlling object (control organ), and another (machine, plant), as the controlled. In some cases, man may transfer the control function to automated machines.

Any cybernetics research begins with systems analysis. All systems considered in cybernetics can be divided into three classes: biological, social-economic and technological. Abstract systems which generalize in some sense the properties of real systems are also built in cybernetics.

Research begins with a substantive description of the structure and laws of the functioning of systems. Then, the process of control task formalization, modeling of the process and the search for algorithms to solve the problems

on computers is implemented. This ends the first part of preliminary systems research.

The second part of research involves the design of the software, hardware, information and legal support of systems.

In practice, design of automatic or automated control systems is completed by technical and economic substantiation: by determining the cost and effectiveness of the control systems.

A major problem in cybernetics is designing classes of systems and formulating tasks for research on the divisions indicated above. Here, the question is essentially designing a classification table with indication of system composition and research tasks. Such a system is necessary for planning work in the field of cybernetics and defining the main paths of its development.

Problems of systematics in science have always been at the center of attention of scientists. For example, the periodic system by D. I. Mendeleyev is considered a true guide in chemistry, physics, biology and other branches of science. Designing such a system in cybernetics is a fundamental problem of our time.

The problem of substantive and formal description of systems belongs to the field of artificial intelligence [1, 2]. Artificial intelligence, a new scientific direction, is being formed on the mating of many scientific disciplines; there are still no precise definitions of an intelligent system and artificial intelligence. The sources of this scientific direction go back to the ancient syllogistics of Aristotle, and today it involves cybernetics, mathematical psychology and linguistics. In the problems of artificial intelligence, the most important is simulation of the external forms of human behavior and its functional relations. A living organism functions in a complex environment. It is necessary to know how to represent knowledge of the external world, build models of interaction with it, design procedures of understanding, and plan system behavior in the environment.

The primary language for representing knowledge (YaPZ) of the external world and communication with the world is our natural language. It has great capabilities, describes reality with the precision and degree of detail necessary for a system and rather accurately reflects the phenomena and facts of the external world in the model of the world stored in our memory. Language characters are codes, the names of information and reality; therefore, natural languages belong to semiotic (sign) systems.

The language of relations is closest to natural languages. Relational languages have immense expressive capabilities and allow describing very complex facts, phenomena and processes occurring in the external world. However, relational knowledge representation languages produce unwieldy notations compared to text in a natural language.

To describe knowledge of small problem domains, the language of predicate calculus is very convenient. In it, predicates play the role of relations.

When classical predicate calculus is supplemented with modifiers and quantifiers, the language of predicate calculus approximates the relational languages.

Much importance has recently been attached to languages of the frame type (M. Minskiy). The word "frame" means the minimal description of events which still preserves the essence of the phenomenon being described (any further reduction of it produces a loss of this essence). In frame descriptions, one frame is included in another as an element and that is how a structure of events is built.

In organizing a transition from a natural language to the language of machines (computers), it is necessary to keep in mind that concealed behind every human word are concepts coming from exolinguistic, sensorial contact with the world. This method of contact is so important to man that even with abstract concepts, human language is always tied to some sensorial concept. In modern computers, there are no sensorial patterns of that which is denoted by words, by characters; thinking is impossible without the presence of such systems of patterns.

By using receptors (vision, hearing, touch, smell), robots sense external information based on metaprocedures and process it in their own computer, but they cannot synthesize sensorial patterns. In an artificial system of the robot type, two systems, independent but functioning together, are still lacking: a sensorial perception system directly reflecting the external world, and a system for sign processing of information about this world. With the simultaneous functioning of these two systems in an artificial system, the prerequisites for implementing the basic metaprocedures of thinking (the machine analog of them) are created.

Understanding is a procedure of communication between the semiotic system of natural language and those patterns which form in us a system of sensorial perception of the world. The process of understanding occurs through a dialog between intelligent systems equipped with a model of the world. Today, a narrowly pragmatic dialog between man and a computer has been successfully implemented. But when the dialog between a man and a robot has a rather broad subject field, difficulties arise in organizing the metaprocedure of understanding (matching texts with facts from the model of the world). Such are some of the problems in building a metaprocedure of understanding.

After implementation of the metaprocedure for understanding, the planning of system behavior in the environment begins. The planning, as a rule, is hierarchical (strategic, tactical, operational, etc.).

Thus, the major problems of artificial intelligence are development of convenient languages for knowledge representation, procedures for processing information obtained by using the sense organs, methods of translating descriptions into internal representations used in models of the world, and procedures affording understanding of texts in natural languages. Further, there is the problem of finding ways to formalize the behavioral aspect for

artificial systems (development of models of setting aims, decomposition of aims and tasks, models of forming of needs and motivations, development of normative logics of behavior, etc.), and in the long term, the problem of active knowledge of collective interaction of intelligent systems, development of methods of organizing collective memory for storing knowledge in a population of robots and methods of transferring this knowledge from one generation of robots to another.

In hardware systems simulating human intelligent activity (for example, in robots), representing knowledge of the environment in the actions of the robot in it remains a central problem.

The problems of cybernetics in studying biological systems are closely related to the complexity and features of that subsystem which is the immediate object of investigation. It is known that such subsystems may be: molecule, cell, tissue, organs, organism, population, ecological systems, biosphere. Each of these subsystems has a complex structure and functions as part of a unified biological system. With that, the principle of system integrity is retained.

A fundamental problem in biological cybernetics is the formalized description of the functions of biological systems on a systems basis. Now, when an enormous amount of material on biological objects and processes has been accumulated, classification of knowledge on the living world by using computers assumes special importance: In essence, it is a question of developing a new systems biology. This problem can be solved through the joint efforts of biologists and specialists in cybernetics.

The application of cybernetics in medicine is especially important. The systematization of knowledge of man, modeling the functions of his organs, and automating the processes of treating patients and managing public health are fundamental problems in medical cybernetics.

There is still no reliable model of the mental activity of man and the processes of evolution of consciousness of children and adult members of society. There are no reliable models of the complex mechanism of the activity of the human nervous system. Therefore, the union of medical specialists and cybernetics is an urgent necessity of our time.

The social-economic system is closely tied to the biological and functions according to its laws. The system includes the intersectorial agencies for planning and management, sectorial and territorial systems, and the system of enterprises.

The largest social-economic system is the Soviet Union, the country of mature socialism where the development of society according to plan is ensured. The basic purpose of functioning of the system is the maximal satisfaction of the needs of members of society. Such a goal is achieved through intensification of production as a result of widespread use of the vast scientific and technical potential.

The resolutions of the 26th CPSU Congress caused widespread introduction of economic-mathematical methods and computers into planning and management of the national economy of the country and development of a network of information centers and automated management systems (ASU) for acquisition and processing of large files of information.

At the same time, new fundamental cybernetic directions of research of social-economic systems related to building automated systems for management of sectors, territorial and union-wide national economic complexes are being formed.

In the first stage of building automated management systems, the computer was used for solving local problems (payroll, supply, etc.). This approach intensified the development of production to a certain extent, but did not yield fundamentally new results.

With the development of automated management systems for major social-economic systems based on multiprocessor computer networks with high throughput, a system-wide approach was required. In fact, human society and the environment form a complex dynamic system with hierarchical structure with feedback. Therefore, a general analysis of the structure of the system and the relations between its parts and with the external environment was required for building systems to manage it. All this led to a natural transition from autonomous to system-wide research. In performing this analysis, the problems of describing systems, standardizing schemes of mathematical modeling, developing industrial methods of programming, and systematizing information flows arise. Designing optimal computer networks with organization of the machine-machine system is a major problem. The transition from local to system designs and the automation of the processes of designing automated management systems and software form a circle of problems in cybernetics not yet solved to the end.

Processing systems differ from other systems by the large variety: machine building, chemistry, metallurgy in industry, crop growing and animal husbandry in agriculture, and this is far from a complete list of them. Included here are transportation and power networks which have a communication nature, and arbitrarily the processes of design of scientific research.

In view of the great diversity of such systems, the description of them is not yet standardized. The mathematical models, which do not always manage to tie the fundamental relations of mechanics and physics to the particular manufacturing processes, are complex; there is no unified hardware system, and microelectronics technology is just getting started.

All these problems are fundamental and await solution.

Models of abstract systems of cybernetics originate in terms of theory as a result of generalization of properties of a broad class of systems. Such models are formalized and most adaptable to the application of computers, and are therefore of special interest in practical applications. Let us list some of the abstract systems.

Models of Automata. The theory of deterministic automata with memory originated based on the requirements for designing discrete computers. The problems of analysis and synthesis of Mealy and Moore automata were elaborated, and languages were designed to describe such automata (V. M. Glushkov).

The problem of behavior of automata in discrete and stochastic environments has recently emerged; the theory of automata with configurable structure and algorithms for training automata in optimal behavior are being elaborated. Serious results have been obtained for switchable random media [3]. Models of controllable automata are finding wide application in modeling queuing systems when solving practical problems such as task flow control in computer networks, automation of product quality control, etc.

At the same time, training automata in arbitrary environments, machine formalization and applying models of automata to automation of production processes nevertheless remain fundamental problems in cybernetics.

Recognition Systems [4]. The algebraic construction of recognition operators has now been completed, and applications program packages have been developed; these systems have been widely implemented in geology, medicine and other fields of knowledge.

A major direction in basic research in the field of recognition is further algebraization of recognition operators by drawing on the ideas and apparatus of functional analysis. Problems of standardization in developing reference systems are of obvious interest.

A major problem is solving the technical aspects of recognition of optical and acoustic patterns and tactile information, i.e. the problem of constructing the systems theory of recognition.

Aggregate Systems [5]. The interaction of elements in complex systems is studied within the framework of a signal exchange mechanism, communication channels are introduced between elements, and the elements themselves (the aggregates) are equipped with input and output poles. It is assumed that the channels are ideal and signals are sent instantaneously without distortions. Non-ideal channels are considered as independent system elements.

An aggregate is characterized by a set of states Z, inputs X, outputs Y and time T (a set of control signals U is also included in the input set). The problem of modeling the functioning of an aggregate is reduced to constructing the sets $z(t)$ and $y(t)$ and the functions dependent on them, i.e. to computing $z(t + \Delta t)$ [5] or their probabilities (in random media) from the given $z(t)$, $x(t)$ and $u(t)$. It is assumed that the state of the aggregate changes by a discontinuity.

The general-purpose automated simulation model (UAIM) of complex systems based on aggregates and aggregate systems is suggested in [5]. Aggregate systems are used to model processes in queuing systems, and manufacturing processes in machine building (machining and assembly), in chemistry and other fields.

Fundamental expansion of the general-purpose automated simulation model is necessary to formalize the design of aggregate systems and standardize the tie-in of them to research of specific objects.

Adaptive Systems. In the area of developments of adaptive systems, substantial results have been obtained in the direction of research related to selecting their parameters on computers. Problems of adaptation of systems in stochastic media are currently under intensive discussion. With that, designing the most general-purpose adaptation systems nevertheless remains a fundamental problem in cybernetics.

Operator Systems. They are a convenient apparatus for implementing modeling algorithms of A-systems on computers. Methods of transition from operator systems to microprogram automata have already been developed [6]. The problem of formalizing the design of operator systems and automating the design of microprogram automata based on them is fundamental.

The list of abstract systems in cybernetics could be continued. The design of new, more powerful abstract systems itself is a fundamental problem in cybernetics.

The problem of automating human mental labor by using computers is now growing into a cybernetics problem involving research on optimal man-machine interaction. In the literature, it has come to be called the man-automaton problem. It is expected that part of human mental labor capable of being formalized will be identified and that the relations discovered will be formulated as logical and analytical relations with subsequent implementation on computers. Solving these problems also involves applying the general ideas of algorithmization [7].

In the theory of algorithmization, ways of formalizing the creative labor of man will lead to development of automated systems for solving formalized creative problems on computers.

Since cybernetics operates on a large variety of systems and models of them, the problem of a standard description of systems emerges in general systems algorithmic research. Any cybernetic system can be described by using four sets (indivisible): workers W, work places R, operations O and products P.

Let us call an aggregate and denote by $A\{W \cdot R\}$ an intersection of sets W and R by features. The composition of these sets is defined by the structure of the system and the statement of the problem. The system can be represented as situation graphs, functioning table systems.

Any aggregate is intended for execution of a certain number of operations for processing the product (matter, energy, information). In the process, the beginning and end of each operation and the inputs and outputs (X, Y) are always defined. Thus, the relations $A \rightarrow O \rightarrow P$, $[A, O, T] \rightarrow T$, where T is time (discrete or continuous) result.

Formalizing the design of the sets W, R, O and P and the structure of their relations for various systems is a fundamental problem of cybernetics. But any change in the composition of a set produces a change in the composition of the others. Therefore, optimizing the structure of the basic sets and designing rational relations between them is of major practical value.

The problem of compiling mathematical models of operations is separate. In this case, the entire arsenal of formal languages is used. In many cases (for example, in social-economic systems), these models can be generated on computers proceeding from the common laws of system functioning.

Designing algorithms for solving, on computers, the equations obtained in modeling involves formalizing proof by the theorem of mathematics. To date, many methods (for example, (G. Simon's) general problem solver et al.) have been suggested. However, the problem of designing axioms and the procedure of substitutions have not been defined to the end and much has to be done on selecting optimal algorithms.

In algorithmic cybernetics, software is implemented by using systems of basic and two auxiliary banks [7]. Algorithmic software has been developed in the field of mechanics of continua, and the SAPLAS system is being used for social-economic systems.

There are many unresolved problems in the field of hardware, information and legal support of systems, and in the methods of structuring the technical and economic substantiation of the automated management systems being designed.

Such is the list of fundamental problems in the field of hardware, information and legal support of systems and in the field of algorithmization in cybernetics.

In time, the sphere of application of computers in the study and control of systems will be expanded rapidly and the demands on fundamental cybernetics will increase. Therefore, the accurate formulation of these problems and concentration of efforts of collectives of researchers on them is turning into a major problem.

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USSR COMPUTER COMMITTEE CHAIRMAN EXPLAINS WORK

Moscow EKONOMICHESKAYA GAZETA in Russian No 18, Apr 86 p 5

[Interview with Nikolay Vasilyevich Gorshkov, chief, USSR State Committee on Computer Technology and Informatics, by V. Denisov, correspondent, date and place not specified: "More Effectively use Computer Technology"]

[Text] Our committee was created in order to improve the creation, use and service of computer hardware, raise its technical standards, quality and reliability. We must attain sharp improvements in the return from computer hardware use, and thoroughly assist in the reconstruction and technical reequipment of the national economy's sectors and accelerate scientific-technical progress.

I think that it is correct to view computer technology as a state resource intended for solving tasks in various areas of activity. One must be thrifty and economical with resource. It is time that we admitted that we do not always use computer technology rationally, and that its development is taking an extensive path.

For example, today we have many thousands of medium productivity machines of the Unified Series type. However, according to TsSU data, they are only used a little more than 11 hours per day, and for so-called productive calculations, only 3-4 hours. That is, only one-sixth of these resources' productive capacity is used. This is one problem.

Here is another. In order for machines to help people and solve specific tasks, it is necessary to "invest intelligence" that is, programs and information, in them. In the past 10 years we have developed more than 700,000 different variations of programs, not more than 8,000 are registered in the all-union fund, while only a few hundred titles [naimenovaniye] are disseminated throughout the country in the form of products [izdeliye].

A paradoxical situation arises: Each computer owner, whether it is an enterprise or association, develops its programs on its own, and, having solved a specific task, forgets that its program might be needed by others to solve similar problems. These others must also begin from zero. This leads to colossal costs. It is still quite difficult to obtain a program ready to go: there are no legal rules or economic norms. Each unit invents something which

would be very much cheaper and quicker to obtain in an organized manner.

Computer hardware, equipped with the needed information, has been created by people, for people and works under human guidance. However, training is required to communicate with machines. Once again, there is a paradox: Qualified programmer specialists are trained at practically all ministries and departments, in the Minvuz system, and at other higher educational institutions, but one cannot "crew" a new machine with them. Where are these people? Nobody keeps account of them, they disolve? in the mass of engineering-technical workers.

In short, today, we are obligated, with full responsibility and consciousness, to improve the quality of all our work.

[Question] The new committee's name includes the word "informatika". Could you reveal the content of this term?

[Answer] In popular speech, this is the science of methods and means for the machine processing of information. More precisely: informatika is the science about the principles and methods for processing and transmitting information.

[Question] Accelerated scientific-technical progress is already making great demands for computer technology by various sectors in the national economy. These demands will unavoidably continue to grow. How realisic is the complete satisfaction of all those who need equipment, programs and personnel?

[Answer] First, let me make this question perfectly clear. There are real requirements of enterprises and organizations for computer hardware, and unfortunately, there is a "fashion for progress", where it is acquired for prestige purposes, to say that "we are no worse off than others". This latter does not take into account real conditions necessary for machines' effective use.

Naturally, such an approach is intolerable to us. In order to overcome it, there must be a study of the real requirements for computer hardware. It is they which must be first of all met through the available resources talked about earlier. There must simultaneously be an energetic increase in new production capacity for computer and information science hardware.

On the other hand, economic managers have a psychological barrier: many of them are still simply afraid of the new technology, they are cautius and prefer to work in the old manner.

This was openly discussed at the CPSU 27th Congress, which, having approved a course for accelerating scientific-technical progress, directed special attention towards the development and mass introduction of modern computer technology. Therefore, we will seriously work on activating the efficient use of computer technology in all sectors. In this work we count on help by the press, television and radio.

The newly formed committee can substantially influence the production and more effective use of computer technology. This is mainly because all these

questions will be concentrated here, in one organization

I recall, that up until now the GKNT planned scientific progress and tracked its tendencies, Gosplan had the rights to directly plan computer technology production and to distribute it, while Gossnab distributed peripherals and data transmission equipment. Understandably, under such conditions it was practically impossible to estimate who needed how much equipment and who was using it. One of our most important tasks is to overcome departmental barriers.

[Question] Can you proceed similarly to intersectorial scientific-technical complexes?

[Answer] Unconditionally. The new committee is essentially the head organization for a powerful MNKT intersectorial scientific-technical complex for the development, production and introduction of computer technology.

The state committee will head a diverse state system. Its direct subordinates are the organizations which we still call centers for computer services (TsVU), covering practically the entire country. Today there are more than 200 of them This number will by the end of the five-year plan. These TsVU also have smaller subordinate units -- PVU points. There are now several thousand computer centers in the country, and the new committ can really control each of them.

It is assumed that our TSVU will become centers for computerization in a given region. They will know exactly who needs how many of what machines, programs and specialists. Thus, representitives from the new committee will locally manage a region's computer potential. They will be concerned about computer conditions, repair and spare parts delivery. As new tasks appear, the TsVU can help with new programs.

Each 50-70 computer centers will form a production association, which is directly subordinate to the committee's central apparatus. Such associations will be created in every republic.

[Question] What are the first, most urgent steps that the new committee will take in the immediate future?

[Answer] The first is the devlopment and approval, within three months, of original documents: the structure, various statutes and decisions about organizations in the committee. In the next few months we will take an inventory of all the country's computer technology and information science resources, analyze their use in all ministries and departments and make suggestions about their more effective use. The work of the State Inspectorate must be immediately organized so that jointly with Gosstandart it can very soon start helping industry to produce highly reliable computer and information science hardware.

Such are our plans.

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BOOK ON EFFECT OF AUTOMATION ON CIVIL RIGHTS REVIEWED

Moscow SOVETSKOYE GOSUDARSTVO I PRAVO in Russian No 2, Feb 85 pp 141-143

[Review by L. K. Tereshchenko, candidate of juridical sciences, and I. B. Yermilin of book "Prava grazhdan i ASU" [Civil Rights and Automated Management Systems], Znaniye, Riga, 1984, 120 pages]

[Text] The authors investigate the problems of the effect of automated management systems on the processes of protection and realization of the rights of Soviet citizens connected with the development of computer hardware and its utilization for servicing the public and for the needs of improvement in planning and in social and cultural development. This study draws the sound conclusion that in the socialist society the automation of management as a whole contributes to a rise in the level of protection and realization of civil, including constitutional, rights and liberties. At the same time, the authors correctly assume that automation can also entail some negative consequences, in particular, connected with the protection of civil rights. This is due to the fact that, along with the concentration of information on them in computer centers and with the relatively free access of computer center workers to this information, the check of the reliability of data, their correction on the basis of citizens' statements, and so forth become complicated.

The rapid development of the processes of collection, transmission, processing, and accumulation of information, including on citizens, is objectively determined by the needs for social management, improvement in planning, and development of the cultural and general sphere. This phenomenon has the tendency toward a further expansion. The authors correctly note the fundamental difference of the consequences of the development of information systems in bourgeois and socialist countries determined by the fact that in the USSR (as in other socialist countries) such systems are in the hands of state bodies and are used exclusively in the interest of society at large. Of special interest are two aspects of the problem analyzed in the monograph, that is, automated management systems and the realization of civil rights; automated management systems and an increase in the guarantees of exercise of civil rights.

In fact, computer hardware has an indirect, as well as a direct, effect on the process of realization of specific rights; for example, the right to work. The realization of the general right to the choice of an occupation and of a type of trade and job and the realization of a specific labor legal relation, including the determination of the suitability of the vacancy candidate and the provision of organizational conditions necessary for the realization of the duties imposed on the worker, are already effected by means of automated management systems. Computers are also used in the calculation of wages, of the amount of a bonus award, of the amount of a pension, and so forth.

The authors generalize the accumulated practical experience in the development within the framework of the Republic Automated Management System--Latvia of an automated job placement information system. The important conclusion that the efficiency of the solution of problems concerning citizens' job placement should lie in a correct singling out of criteria taking into consideration the aspects of management of labor resources is drawn on the basis of an analysis of this system. At the same time, the demand for the correspondence of the indicated criteria to law is very important. On the one hand, the criteria used in the "vacancy-candidate" problem are insufficient for a legally correct solution of the problem (for example, such criteria as the existence of age restrictions in the hiring of minors, restrictions connected with the state of health or commission of a crime, and so forth are absent) and, on the other, individual inquired criteria in accordance with labor legislation cannot be obtained (for example, the demand for an indication of the reasons for dismissal).

The book also examines the utilization of automated information systems in other spheres of realization of civil rights and liberties, that is, the right to housing, the right to rest, the right to financial security in old age, in case of sickness and of a complete or partial disability, and so forth. Information on possible exchanges of apartments and on the availability of passes to rest homes and sanatoriums, pension calculations, and so forth--all this represents a real use of computers in the exercise of civil rights.

The problem of raising the level of guarantees of civil--financial, organizational, and legal--rights is connected both with the general positive role of automated management systems in national economic management and with the specific functions of some systems in the sphere of recording and reporting, planning, and so forth.

Much attention is given to such an important problem as an expansion of the forms of workers' participation in production management by means of automation, that is, the further development of democracy. Automated systems make it possible to sharply improve information support for workers, as well as to solve a number of new management problems. The authors reach the conclusion that computer hardware can provide considerable assistance to workers when the socialist competition is summed up and that the recording of workers' proposals and remarks, the choice of optimum decisions, and so forth can be organized by means of it.

At the same time, the book also contains a critical interpretation of the available experience in the application of computers, which is important for a

discussion of further ways of utilizing computer hardware with due regard for the realization of civil rights. For example, using specific examples, the authors show that in individual cases the practice of utilization of automated management systems for the stimulation of workers' labor does not meet the demands of legal norms and, as a consequence, does not ensure the proper effect of the award of bonuses on an increase in production efficiency and labor productivity. One must agree with the authors that the referral of a number of problems, such as the establishment of workers' guilt, determination of the degree of their responsibility and, accordingly, award and nonaward of bonuses, to the Information Computer Center for decision is inadvisable and can involve an infringement of workers' rights and legal interests.

The book gives a negative evaluation to the practice of embodiment in the standards of enterprises used in the automated product quality control system of problems of financial responsibility, in particular, for poor-quality products, and of moral and financial incentives, that is, relations, which are the objects of regulation of the norms of administrative, civic, labor, and other branches of law. The authors' remark to the effect that such a practice hampers the implementation of a single policy in the development of overall product quality control systems and, consequently, the accomplishment of economic and social tasks set in the draft of the party program (of the new edition) seems correct. The proposal on the adoption of a special government decree, which would accurately determine the list of standardization projects at an enterprise level, deserves attention. Furthermore, for the purpose of raising the level of legality in the development of enterprise standards, the authors propose an improvement in the process of a legal expert examination of the drafts of enterprise standards.

In connection with the development of credit issue systems, automated trade enterprise management systems, and so forth the book examines the urgent problem of protection of customers' interests under the conditions of functioning of the automated system for the processing of information on prices. The price policy is a sphere directly connected with citizens' interests. To contribute to the implementation of the price policy envisaged by the party and to intensify the control over the observance of prices are some of the important tasks of the automated system for the processing of information on prices.

Insufficiently studied, new problems arise when computer hardware is used in areas connected with the protection of citizens' private lives. Stressing the need for a strict and systematic observance of the constitutional statute on the protection of citizens' private lives, the authors note that under the conditions of the collection of information on citizens in various automated information systems norms protecting some aspects of the social sphere, which can be designated as "private life," are established in some departmental normative acts. However, a single legislative act, the need for which is urgent, does not exist yet. The authors made an interesting attempt to uncover the content of the concept of "private life." A disputable, but very interesting, construction of "three spheres" of private life--official, contact, and intimate--and also the traits and qualities of the individual himself, which bind like a "reinforcement" all the three spheres are

introduced. Unfortunately, the book gives neither the definition, nor the content, of the individual's social life, which the authors use, uncovering

the concept of "private life" and analyzing the correlation between each of the proposed spheres.

On the basis of an analysis of the state of protection of the secret of private life the book draws a valid conclusion on the need to eliminate gaps in the law, as well as to unify legal norms in a single legislative act. It is noted correctly that the urgency of this problem increases in connection with the development of an ever broader range of information systems.

The importance and complexity of the investigated problems of protection of private life under the conditions of automated management systems requires their further discussion. The fact that the authors raised these problems and presented their concept, most of the provisions of which seem convincing and will be very useful in the further elaboration of the problem of protection of citizens' private lives under the conditions of automated management systems, is to their credit.

An efficient evaluation of the class content and of the restriction, inevitable under the conditions of the capitalist society, of legislation and the practice of its application in this area, of its social direction, and of the utilization of automated management systems for police and fiscal purposes is given with arguments and from Marxist positions.

In conclusion we would like to note that the reviewed book is useful both for scientific and practical workers engaged in problems of legal support for automated management systems and represents good material for the further investigation of the problems raised, as well as for draft legislation work.

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HARDWARE

UDC 681.3.06:519.8

MINIMIZATION OF NUMBER OF PROCESSORS IN REALIZATION OF HOMOGENEOUS COMPETING PROCESSES

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 29 No 12, 1985 (manuscript received 27 Nov 84) pp 1082-1085

[Article by M. I. Ovseyets, Institute of Mathematics, Academy of Sciences BeSSR]

[Abstract] In parallel processing in multiprocessor systems optimization problems arise as to access to common system program resources. The problem is considered of determining the minimal number of processors necessary for carrying out a set of competing homogeneous processes in a minimum time (homogeneous processes have the same program block execution times for all processes). The system considered requires that a program block be executed by a process localized in a single processor and that the programming be linear, i.e., that it be structured as a series of blocks to be executed serially. Formalizations are given for the minimum number of processors required for the three main modes of interaction of processes, processors and program blocks, i.e., asynchronous, continuous execution of the set of program blocks by each process and ocntinuous execution of each program block by competing processes located in different processors. The conditions are imposed that each program block must be processed by one processor at a time, each processor must process only one block at a time and each block must be processed continuously. The minimal number of processors necessary is found for the first two modes and for one class of the third mode while upper and lower bounds are defined for the remaining cases. References 6 (Russian).

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CONSTRUCTION OF MICROPROCESSOR TESTS. II. DATA STORAGE AND TRANSMISSION CHECKING

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 1, Jan 86 (manuscript received 23 Jul 84) pp 139-150

[Article by V. P. Chipulis and S. G. Sharshunov]

[Abstract] This article extends a previous paper that presented a general model of a microprocessor as the collection of functions implemented by the microprocessor equipment. Sets of mechanisms for data processing, processing control, data transmission and storage, and data transmission control were singled out, and microprocessor testing was defined as the aggregate of the tests of all of the individual mechanisms. The present study examines testing of the data storage and transmission mechaism, as well as the data transmission control mechanism, which performs register selection. Models are developed for testing the data transmission and storage mechanisms and the register selection mechanism, as well as models of malfunctions that can occur. The procedures developed are sufficiently universal, and can be used to test register decoders, multiplexers, and demultiplexers, and also to detect operation decoding malfunctions that result in incorrect selection of information sources and recipients. Figures 3, tables 3, references 2: 1 Russian, 1 Western.

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PRODUCTIVITY OF COMPUTERS WITH BUILT-IN HARDWARE TESTING

Tbilisi SOOBSHCHENIYA AKADEMIKII NAUK GRUZINSKOY SSR in Russian Vol 120 No 1, Oct 85 (manuscript received 28 Oct 83) pp 141-144

[Article by G. A. Gavaketashvili]

[Abstract] Problem solving on a computer that incorporates unreliable built-in hardware testing is analyzed. In order to minimize lost information in case of a malfunction, the applications problem is divided into a number of parts, and each part is divided into stages. The result of each stage is placed in an accumulator, where it remains in case of a malfunction. When a malfunction is detected by the testing hardware, the computer if repaired and the disrupted stage of the problem is recomputed. In case of malfunctions that are missed by the testing hardware, or in case of a malfunction of the testing hardware itself, a periodic integrity test procedure is employed at the end of each part of the applications problem, and all results beginning with the last correctly stored part are discarded. References 4 (Russian)

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UDC 861.242.35

ASSESSMENT OF RELIABILITY OF SYSTEMS RECOVERED FROM VARIOUS TYPES OF MALFUNCTIONS

Tbilisi SOOBSHCHENIYA AKADEMIKII NAUK GRUZINSKOY SSR in Russian Vol 120 No 1, Oct 85 (manuscript received 25 Dec 83) pp 145-148

[Article by T. Z. Chumburidze and Z. I. Mikadze]

[Abstract] An expression is derived for the availability factor of recovered systems that employ continuous built-in partial hardware testing as well as periodic full-system testing in which malfunctions occur that may or may not be detected by the test equipment. Recovery of a malfunctioning system is initiated as soon as a malfunction is detected, or when a missed malfunction is found by periodic testing. References 4 (Russian).

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UDC 681.322.6:513.86

AN APPROACH TO AUTOMATIC SYNTHESIS OF PARALLEL SIMULATION PROGRAMS

Tbilisi SOOBSHCHENIYA AKADEMIKII NAUK GRUZINSKOY SSR in Russian Vol 120 No 1, Oct 85 (manuscript received 22 Mar 84) pp 149-152

[Article by Z. A. Gasitashvili and I. A. Stepanovskaya]

[Abstract] This study describes an approach to the automatic synthesis of parallel programs that simulate computers during the structural design phase. The proposed models, which are based on Petri networks, provide the capability of describing the objects under design, as well as organizing the design properly, including parallel processing and pipelining in the simulated system. References 1 (Russian).

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UDC 519:71;519:95

ON CLASSIFIERS IN PARTIAL PRECEDENCE ALGORITHMS

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 6, Nov-Dec 85 (manuscript received 20 May 85) pp 9-13

[Article by M. M. Kamilov, R. T. Abdukarimov, and R. M. Normatov, Uzbek Cybernetics Association of Science and Industry, UzSSR Academy of Sciences]

[Text] Various recognition algorithms, with an identical percentage of object recognition errors for a test sample, yield different subsets of these erroneous objects. There may also be subsets which do not intersect. So, among all the algorithms, it is difficult to choose the best for solving a specific problem. In cases of an unknown type of probability distribution, nonparametric recognition methods have broader selection capabilities.

Nonparametric algorithms may include those with piecewise linear decision functions (KLF) and algorithms for computing estimates (AVO) [1]. In the process of improving the latter, a new class of algorithms was formed and is now in use: the class of partial precedence algorithms (AChP) which allows, by avoiding the algorithms for computing estimates--the longest phase in the search for optimal algorithms--to correctly recognize 100 percent of the objects in a training sample [2-4].

The class of partial precedence algorithms was in turn supplemented by new algorithms, based on coverage of the classes by polyhedral logic classifiers (MLK) [4], which, in addition to complete separation of the objects in a training sample, provide the capability of more flexibly and precisely distinguishing the objects in a test sample as a result of reducing the regions of rejects and errors located on the boundaries between the classes.

Let there be a set of objects $G = \{S\}$, $S_i = \{a_{ai}\}$, where a_{ai} is the value of the feature α of the i-th object; G consists of l classes $\bigcup_t G_t \subseteq G$, $t = \overline{1, l}$. From the sample $M \subset G$ (training information)- $M_t \subseteq M$, $M = \{S_\beta\}$, $\beta = \overline{1, m}$, $M_t = \{S_i\}$, $i = \overline{1, m_t}$, $M \setminus M_t = \{S_j\}$, $j = \overline{1, \tilde{\tilde{mt}}}$, m is the capacity, it is necessary to synthesize a rule (algorithm) which forms a description of the pattern so that the extrapolation of M to G optimally would recognize any implementations of $S_x \in G_t \setminus M_t$.

The rule which establishes the presence of similarity between two objects by one or a complex of features is called the rule of correspondence (p.s.). For example:

$$d_\alpha(S_i, S_j) = \begin{cases} 1, \text{ when } |a_{\alpha i} - a_{\alpha j}| \leqslant \varepsilon_\alpha, \\ 0 \quad \text{otherwise}, \end{cases} \qquad i \neq j.$$

By successively applying the rule of correspondence to the rows-objects of the matrix $\|a_{\alpha\beta}\|_{n\times m}$, between two rows, the rows of values of d_α can be obtained as a state vector b_α:

$$b_{\alpha_{h+1}} = \begin{cases} 1, \text{ when } d_{\alpha h}(\boldsymbol{S}_\beta, \boldsymbol{S}_{\beta+1}), \\ 0 \quad \text{otherwise}, \end{cases}$$

where h is the iteration step in comparing the objects $\mathbf{S}_\beta$ and $S_{\beta+1}$.

Rule D, by which a zero or one is set for any S_β by the formula

$$D(Z, S_\beta) = \bigwedge_{\alpha=1}^{n} [b_\alpha \to d_\alpha(Z_\alpha, a_{\alpha j})]$$

is called an elementary logical classifier (ELK) with the center at point Z with state vector $\boldsymbol{b}_\alpha$, source system of the rule of correspondence, $\overline{d_1, d_n}$ with rank $r^* = \sum_{\alpha=1}^{n} b_\alpha$ and interval N (N is the subset of objects $\boldsymbol{S}$ of M_t, for which $D(S_\beta)=1$).

An elementary logical classifier can be considered an algorithm which governs entry into a particular subarea of classes. An elementary logical classifier D_ω^A with interval N_ω^A is called admissible when $N_\omega^A \subseteq G_t \, (t = \overline{1, l})$.

An elementary logical classifier D_ω^A is called maximal over the interval in set $\{D_\omega^A\}$, when $N_{\omega t}^A \cup N_{\omega' t}^A \subseteq N_{\omega t}^A$, $\left(\forall_{\omega'} \left| N_{\omega' t}^A\right) \subseteq M_t \setminus N_{\omega t}\right)$.

After all admissible elementary logical classifiers D_ω^A have been constructed, they can be combined into full coverage of class t. Full coverage of class M_t means any S_β of M_t is included in at least one elementary logical classifier D_ω^A, i. e. $M_t \subseteq \bigcup_{\omega=1}^{\eta_t} N_{\omega t}$.

The coverage is called nonredundant when no elementary logical classifier can be removed from it without destroying its completeness.

Theorem 1. For any subset G_t, isolated from the set $G \setminus G_t$, at least one full coverage will always be found. The proof is given in [2]. The highest number of possible coverages may be large ($2^{m \times 2^n}$). Therefore, the problem arises of finding the optimal algorithm, for the simplification of which the predicted estimate of algorithm quality is suggested in [2].

The problem of finding the optimal algorithm is considerably simplified when the χ-optimal coverage is found immediately.

Definition 1. Nonredundant coverage of M_t by admissible and maximal elementary logical classifiers over the interval, which produces correct recognition of all S_β of M, is called the χ-optimal coverage.

Let $\omega = \overline{1, \eta}$, η is the number of elementary logical classifiers in M_t.

Statement. For the nonredundant coverage of $M_t \subseteq \bigcup_{\omega=1}^{\eta} N_{\omega t}$, it is necessary and sufficient that each elementary logical classifier $D^A_{\omega t}$ of this coverage contains at least one proper object S^0_β [3]. A proper object S^0_β is one such that

$$S^0_\beta \in N_{\omega t} \setminus \left(M \setminus S^0_\beta\right), \quad S^0_\beta \in N_{\omega t} \setminus \bigcup_{\omega=1}^{\eta} N_{\omega' t},$$

where $\omega' = 1, \ldots, \omega - 1, \omega + 1, \ldots, \eta$.

Theorem 2. For the existence of the χ-optimal coverage, it is necessary and sufficient that these four requirements are met:

1. $\forall_t \left(M_t \subseteq \bigcup_{\omega=1}^{\eta} N_{\omega t}\right)$	completeness of coverage,
2. $(M_t \setminus N_{\omega t}) \cap N_{\omega t} \neq N_{\omega t}, \ \forall_\omega$	nonredundancy,
3. $M \cap M \setminus M_t = \varnothing$	admissibility,
4. $N_{\omega t} \cup N_{\omega' t} \subseteq N_{\omega t}, \ \forall_{\omega'} \ (N_{\omega' t} \subseteq M_t \setminus N_{\omega t})$	maximality of the elementary logical classifier.

Despite the optimality of coverage in the training sample, the χ-optimal coverage may not be stable for objects in the test sample since there may be regions of failures (for example, areas of intersection of elementary logical classifiers from different classes) or regions of errors (coverage of free areas) at the bounds between classes.

To raise the accuracy of algorithms at the bounds between classes, a special type of rule of correspondence is suggested in [3]:

$$d_\nu(S_\beta) = \begin{cases} 1, \text{ when } \sum_{\alpha=1}^{n} k_{\alpha\nu} a_{\alpha\beta} + b_\nu \geqslant 0, \\ 0 \text{ otherwise} \end{cases}$$

in which hyperplanes $\sum_{\alpha=1}^{n} k_{\alpha\nu} a_{\alpha\beta} + b_\nu = 0$ are selected so that they divide optimally some boundary subset Q_ν (Q_ν is a convex subset of objects of the training sample from adjacent classes located on the boundary between these classes [4]).

When $S_i \in M_i$, and $S_j = M \setminus M_i$, let us call the value of the logical function $d_\nu^*(S_i, S_j) = d_\nu(S_i) \oplus d_\nu(S_j)$ $d_\nu^*(S_i, S_j) = 1$, a logic discriminator (l.d.). The l.d. if objects S_i and S_j lie on the same side of the hyperplane ν; otherwise, it equals 0.

After constructing a system of hyperplanes d_ν, one can construct the χ-optimal coverage with the previously specified property of optimality of division of classes in the sense of the criterion of equal probability that the hyperplane points belong to the classes in the teaching sample. The analogy of partial precedence algorithms to those for piecewise linear division may be noted [5]. When the object-feature matrix $\|a_{\alpha\beta}\|_{n\times m}$ is replaced by the object-inequality matrix $\|d_{\alpha\beta}\|_{\mu\times m}$,

let us use the base algorithm [2] to analyze the incompatible systems of linear inequalities. In doing so, a deeper link is detected: admissible elementary logical classifiers with maximal rank, found by the base algorithm, correspond to the maximal simultaneous subsystems of linear inequalities (MSP LN).

Definition 2. The classifier $D_m(S_\beta) = \bigwedge_{\nu=1}^{k} (b_\nu \to d_\nu^*(S_\beta))$, where logic discriminators d_ν^* are selected as $d_\nu(S_\beta)$, is called a polyhedral logical classifier (MLK).

A polyhedral logic classifier can be considered an n-dimensional convex polyhedron described by a maximal simultaneous subsystem of linear equalities. The admissibility of a polyhedral logic classifier consists in the fact that only objects of the same class are the solutions to this maximal simultaneous subsystem of linear equalities.

When the subsets $Q_\nu = \{S_\beta^*\} \subseteq M$ of objects S_β^* are selected as boundary subsets such that they can always be divided into two subsets Q_ν' and

$Q_\nu \setminus Q'_\nu$ so that $Q'_\nu \subset M_t$ and $Q_\nu \setminus Q'_\nu \subset M \setminus M_t$, the optimal hyperplane can always be constructed. A noniterative method of determining the coefficients k_α in the equation $\sum_{\alpha=1}^{n} k_{\alpha\nu} a_\alpha + b_\nu = 0,$ which is reduced to solving n linear equations with n unknowns, is suggested in [4] for construction of such hyperplanes.

Let the bounds of the feature space hypercube R^n be included in an incompatible system of linear inequalities (NSLN)

$$U = \left\{ d_\nu^* (S_\beta) / S_\beta \in G \right\}.$$

Definition 3. Let us call any (incompatible system of linear inequalities) $U = \left(d_\nu^+ (S_\beta) / S_\beta \in G \right)$ complete if for every S_β of G, an isolated convex polyhedron D is found such that when $S_i \in D$, $\forall S_j \left(S_j \in M \setminus M_t \right)$ satisfies the condition $S_j \in D$.

Theorem 3. In any complete system U, there is always χ-optimal coverage of classes by those polyhedral logic classifiers $D^M_{\omega t}$, the subset of solutions of which N^M_t satisfies the condition $\bigcup_{\nu=1}^{\mu} Q^M_{\nu t} \subseteq N^M_t \left(Q^M_\nu \in M_t \right)$.

The proof stems from theorem 2 and definition 3.

Based on what has been presented, one can synthesize algorithms of χ-optimal coverage by polyhedral logic classifiers, in which the rule of correspondence satisfies the conditions of optimal division of each $Q_\nu (V_\nu)$, as a consequence of which, the regions of failures and errors occurring between classes are reduced. Let us describe one of the algorithms implemented:

Step 1. The pair of closest objects from adjacent classes $\left(S_1^*, S_2^* \right)_\nu$ is recorded, i.e. $S_1^* = S_i^* \in G_i$ and $S_2^* = S_j^* \in G \setminus G_i$ that $\min \rho \left(S_i^* S_j^* \right)$ is reached, where ρ is the separation;

Step 2. The n + 1 objects S_β^* of $\{S_\beta\}$ nearest the object $S_{y\nu} = \left(S_{1\nu}^* + S_{2\nu}^* \right)/2$; is recorded;

Step 3. The center of the subset $\left\{ S_\beta^* \right\}$ is found, i.e. $S_\nu^* = \sum_{\beta=1}^{n} S_{\beta\nu}^* / n+1$, and in the subset $\left\{ S_\beta^* \right\} = Q_\nu$, that $S'' = \left\{ S_{\beta\nu}^* \right\}$ for which $R_h = \max \rho \left(S_i^*, S_\nu^* \right)$,

is found, is replaced by the object $S^b = (S_\beta \in G \setminus Q_\nu)$,

at which $R_{h+1} = \min \rho(S^b, S^*_\nu)$, $h = h + 1$ is true;

Step 4. Steps 3 and 4 are repeated for new Q_ν until max R_h is obtained;

Step 5. The $Q_{\nu h}$ found is recorded and through n centers of the segments S^*_i, S^*_j, i.e. through $S^*_{y_\nu} = (S^*_i + S^*_j)/2$, a hyperplane is implemented by means of the solution to the matrix $\|a^*_{ay}\|_{n \times n}$, where $a^*_{ay} \in S^*_{y\nu}$;

Step 6. The closest incorrectly separated object of $G \setminus G_t$ is found, i.e. $S^-_{\nu+1} \in \{S_j\}$ such that $d_\nu(S^-_{\nu+2}, S^*_{i\nu}) = 1$;

Step 7. The new Q_ν relative to $S^-_{\nu+1}$ is built during repetition of steps 2 to 8 until an admissible polyhedral logic classifier is obtained, i.e. $\bigwedge_{\nu=1}^{\mu} d_\nu(S^-_{\nu+1}, S_i) = 0$, $\forall S_j \in G \setminus G_t$;

Step 8. After excluding subset N_ω of the polyhedral logic classifier derived, steps 1 to 8 are repeated until full coverage is obtained;

Step 9. Steps 1 to 9 are repeated until all classes are covered;

Step 10. The class of the unknown object is defined as that class, in the polyhedral logic classifier of which this object was included.

The recognition program implemented on the basis of χ-optimal coverage by a polyhedral logic classifier in the FORTRAN language was tested on objects in medicine and cotton-growing. Program results obtained for a training sample with a complex division of classes (training sample of 20 x 100 x 2 (n x m x 1), test sample 20 x 90 x 2) are compared in the table.

Experiments with the programs showed that greatest advantage of the polyhedral logic classifier method, compared to other methods, is found when the training samples have a complex distribution of objects in feature space, especially when the separating hyperplane between classes has a complex curvature.

When the training samples have concentrated subsets characterized by small complexes of features, the algorithms for computing estimates, elementary logical classifiers or closest neighbors have the advantage since they require less computer time and resources while the percentage of errors is the same.

Table

Algorithm	Reference Set	Decision Rule	Operating Time	Error, %
Closest neighbor method	G	min ρ	11 s	20.3
AVO	G	19 ω-parts	39 s	19.1
ELK	13 ELK	96 thresholds	55 s	17.2
KLF	G	26 hyperplanes	33 min	13.1
MLK	9 MLK	21 hyperplanes	29 min	11.6

Key:
AVO [algorithm for computing estimates]
ELK [elementary logical classifier]
KLF [piecewise linear decision functions]
MLK [polyhedral logic classifiers]

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ON ONE DIRECTION IN EVOLUTION OF DATA PROCESSING SOFTWARE

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 6, Nov-Dec 85 (manuscript received 21 May 85) pp 13-16

[Article by Sh. Kh. Fazylov and L. V. Kalyagina, Uzbek Cybernetics Association of Science and Industry, UzSSR Academy of Sciences]

[Text] Software access to researchers depends on their training in programming and knowledge of data processing methods. In connection with this, one can identify categories of users (specialists in their own subject area), each of which determines the type of required software (libraries of programs, applications software packages, processing systems).

The programmer user category includes specialists in data processing capable of using data processing software (usually libraries of programs) as system software in developing their own applications programs.

The professional user category includes specialists familiar with processing methods, but lacking the capability of independently developing software to solve his own problem. The user in this category usually turns to applications software packages and selects a particular processing method without being concerned about its program implementation. In the process, naturally, he must grasp the applicability of the algorithms selected to the data analysis.

The majority of data processing software (BMDP, SSP, OTEKS, SIAD, PPSA et al.) currently known is oriented to these categories of users since the user must have at least the appropriate training in data processing methods to use these resources efficiently.

The largest category of programmer [as published] users includes, just as in the preceding cases, specialists in their own subject area, but poorly, or not at all, familiar with processing methods. For users in this category, working with a data processing system (SOD), which is one multifunctional program in which procedures may operate either automatically as a unified system or as independent modules, is preferred. Chains of procedures in the first case are organized by a special control program based on specifications formulated by the user; in the second case, the user can call individual modules and use them in an autonomous mode to solve his problem.

An example of this type of software, in particular, is a system for processing various types of SITO [1]. Work by the nonprogrammer user with these systems is essentially based on the concept of a computer experiment, proposed for solving problems of numerical analysis, and an increase in validity of results from solving them has been assumed [2].

More broadly, a computer experiment means giving an end user a computer and its software as some experimental installation for tests of hypotheses and assumptions by the user about a process or phenomenon under investigation. In doing so, in the data processing (or rather experimenting), it is not only and not so much the data description (editing, conversion of attributes, etc.), but the initial assumptions and hypotheses (i.e. user knowledge which is difficult to formalize), that are varied; this results in processing which gives the end user the most complete picture of the phenomenon under investigation from various positions.

Proceeding from this position, processing of experimental data must proceed in several phases, each of which is governed by different initial prerequisites and, perhaps, by the researcher's intuitive knowledge. One-time access to a system yields a solution only when the prerequisites have been defined, while when the hypotheses are varied for the data (phenomenon investigated), the work on analysis includes other chains of algorithms and methods, which by mutually overlapping, allow the user to successively refine his knowledge of the data, and that means about the phenomenon under investigation too.

The interactive mode of operating with such a system, on the one hand, intensifies the psychological aspect of such experimenting (searching for facts, confirmation or rejection of a hypothesis), and on the other, allows implementing a more flexible strategy of processing based on the user's judgment (often not formalized) and on-line responses.

Thus, a major direction in the evolution of data processing software is the development and propagation of systems which would allow users who are not programmers to efficiently process data on computers, fully utilize their professional knowledge in the processing, and correctly interpret the results obtained.

The program for further research in this direction must consider, in our view, first, developing multifunctional integrated data processing systems and, second, giving these systems the properties of program products. The ideological basis for creating such systems is the integrated approach to data analysis according to which system operation must be based on three principles [3]: integration of data, integration of methods, and integration of means.

A processing system, developed with regard to these principles, will allow investigating the relation of various types of features, revealing concealed quantitative relations for nonquantitative features based on studying the concordance of changes of these features, ensuring the validity of conclusions as a result of the joint use of processing methods based on mathematical models which are not correlated in their functional capabilities, and

performing, in the necessary cases (when processing large files of information), the functions inherent to a data base management system (generating various subsets of the initial file according to the principles specified, dynamic additions, checking and condensing accumulated information et al.).

A basic task in developing such data processing systems is generating the algorithms which depend on the composition of the data analysis problems, for the solution of which the system is oriented, on the logical scheme of analysis on which it is based, and on data type and structure.

Experience in operating known data processing software may prove very useful in this plan. Thus, based on a comparative analysis of software intended for solving problems of classification and reduction of dimensionality of multidimensional observations, the following content of the library of programs for the section "Classification and Reduction of Dimensionality" is suggested in [4]: parametric and non-parametric methods of classification; decomposition of the mix of several general sets known to an accuracy of the parameters; methods of cluster analysis; method of main components and factor analysis; heuristic methods of reducing dimensionality.

Similarly, structures and content of the library of programs for the section "Statistical Study of Relations" are described in [5].

However, the majority of methods making up the content of these libraries is oriented to work with values given in Euclidean space. They can not be used in processing non-quantitative data. In connection with this, research involving propagation of classical methods of statistical analysis for non-quantitative indicators by defining the relation of order with subsequent introduction of metrics for non-quantitative scales are of great interest. For example, a method of inducing the relation of order for a scale of items was developed in [6] for the multidimensional case; based on this, generalization of quantitative models of regression and factor analysis to biased descriptions is suggested.

Widespread application of software (including data processing software too) is facilitated by the presence in it of the properties of program products. On the one hand, this is the possibility of mass distribution of the software, installation of it in various VTs [computer centers], and operation by end users who have no contact with the developers [7] (affording these properties causes no fundamental difficulty); on the other hand (which is especially important for data processing system), this is the development of a set of software (a family of data processing systems), which contains the appropriate versions for each class of computer (general-purpose, minicomputers, personal computers). Keeping in mind the development of a family of data processing systems, it is necessary to first of all provide for development of the system nucleus and assurance of continuity of results obtained in using different versions of this family.

The system nucleus is the part which affords the basic functions of the system: organization of storage of information necessary for functioning of

algorithms, communication with the user, organization of input and output, and operation of a set of algorithms for solving the user's problems.

Continuity of versions means that they must contain the nucleus and be expanded by service algorithms and programs for implementing the principle of integration of methods so that solutions obtained in low-end versions of the system match results of processing by high-end versions and are only refined (as a consequence of both accuracy of computations and expansion of the spectrum of algorithms). Obviously, to compare results obtained in different versions for the same data, the forms of representation of source data and both intermediate and end results must be standardized.

Thus, the general scheme of analysis and processing of experimental data remains unvarying from version to version; individual blocks called to solve a user's problem are subjected to change (or rather expansion).

These principles of an integrated approach to data analysis have been implemented in part in the SITO system (in the ALGOL language version for the Cyber-172 computer). System operating experience has shown its high efficiency in operation with a wide spectrum of practical problems. The successful solution of them has confirmed the correctness of the methodology used as the basis for the system and the principles for implementing it. On the other hand, the lack of standard software for such a purpose for the YeS [Unified System] and SM [Small System] series of computers has caused the necessity of developing the corresponding versions of the SITO system. Further development of these versions will evidently be aimed at maximal implementation of the principles of the integrated approach to data analysis.

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REDUCTION OF RELATIONAL MODEL WITH INFINITE AREAS TO CASE OF FINITE AREAS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286 No 2, 1986 (manuscript received 29 Jul 85) pp 308-311

[Article by A. K. Aylamazan, M. M. Gidula, A. P. Stolboushkin and G. F. Shvarts, Pereslavl-Zalesskiy (Yaroslavl Oblast) Branch of Institute of Cybernetics Problems, Academy of Sciences USSR]

[Abstract] A problem concerning query language for data base management using first order predicate calculus in relational model data bases is considered. The stored relations are always finite but the relational calculus formulas which are responses to queries may have a range which is an infinite set and cannot be processed. These meaningless or nonconstructive formulas have been eliminated by a procedure ensuring safe formulas but involving conditions leading to the elimination of many formulas, some of which were finite. It is shown that the set of constructive responses for any data base cannot be determined but a formalization is proposed showing that it is possible to transform any response into a constructive formula. This is based on the idea that since the original data formulas are finite and the relational data language cannot distinguish elements not included in them, it is possible to eliminate the infinite sets and reduce all formulas to finite form. The concept can be used for realizing query languages for large but finite data domains where the present language does not cover the entire domain. References 5: 3 Russian, 2 Western.

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METHOD FOR OPTIMIZING PARALLEL PROGRAMS DURING COMPILATION

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian No 2, Nov 84 (manuscript received 26 Oct 84) pp 318-388

[Article by O. M. Davitashvili]

[Abstract] A method is proposed for optimizing parallel programs during compilation on MIMD multiprocessor computer systems. In the proposed method, the WAIT operator is removed if the post-sector of the main branch consists of a single linear sector; if not, the post-sector is "cleared", i.e., the possible arithmetic operations that are performed over the data belonging only to the input data set of the main branch are moved from the post-sector to the pre-sector. These transformations reduce program execution time significantly, especially the complete elimination of the WAIT operation, while requiring little additional memory. The optimization methods can be used when there are numerous lateral branches and more complex post-sector structures.

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AUTOMATED CONTROL SYSTEM FOR SELECTION PROCESS DEVELOPED

Moscow ZHIVOTNOVODSTVO in Russian No 2, Feb 86 pp 16-18

[Article by V. I. Vlasov, doctor of agricultural sciences: "Control of Selection With the Use of a Computer"]

[Text] Under present conditions selection work requires vast information on pedigree animals and its processing by genetic-mathematical methods. This is impossible without the use of a computer, which makes it possible to accumulate the information necessary for the breeder and to issue it in the form of different kinds of data for an operational control of selection.

On this basis the institute is developing an automated control system for the selection process, whose structure is represented in the diagram.

The institute has developed a system for the collection, accumulation, and processing of initial zootechnical information on dairy cows. It consists in a one-time input of initial information on a fixed date with a subsequent issue of the only machine-formed input document--"Act of Control Milking and Events with a Cow"--for groups of cows assigned to a machine milking operator. The document arrives on the farm, where the pedigree stock work recorder enters in it initial data on control milking according to the frequency of milking adopted on the farm and of the number of control milkings per month (at the same time, nothing has to be calculated and the milk yield result itself is recorded separately for each milking) and the results of insemination, calving, steaming up, and so forth.

On the basis of initial data for an operational control of the herd and selection in it the computer prints eight output forms [see following page].

At the same time, the accumulated information serves as the basis for the determination of the pedigree stock value and calculation of selection indices of primapara cows and for a preliminary selection according to them of the best cows for obtaining bulls.

Information on calving is also used for an automated formation of the calf's genealogy with the use of previously recorded data on the father and mother.

No	Name of Document	Frequency of reception	Intended for
1	Cow steaming up schedule	Monthly	Zootechnicians, farm brigade leaders, and machine milking operators
2	Cow calving schedules	Monthly	Zootechnicians, farm brigade leaders, artificial insemination technicians, and machine milking operators
3	Milk productivity of cows	Monthly	Chief zootechnicians, selection zootechnicians, pedigree stock work recorders, and farm specialists
4	Length of service and dry cow periods	Monthly	Selection zootechnicians and pedigree stock work recorders
5	List of cows for control of physiological state a) checked for pregnancy b) inseminated 3 times and more c) not inseminated after calving for more than 30 days d) repeated control of pregnant cows e) repeated control of sterile cows	Monthly	Veterinary gynecologist and selection zootechnician
6	List of primaparas evaluated according to productivity during 90 days of lactation	Monthly	Selection zootechnician
7	Evaluation of bulls according to the quality of offspring	Monthly	Selection zootechnician
8	Operational control of the state of cow reproduction	Monthly	Farm manager, chief specialists, and farm specialists

The interrayon pedigree stock association is another important structural subdivision in the network of the pedigree stock service. For this link institute workers together with specialists of the Pereyaslav-Khmelnitskiy Interrayon Pedigree Stock Association have developed their system of collection, accumulation, and processing of information on sires. At the same time, initial information on the quantity and quality of the sperm in the ejaculate of every bull is received from the input document "List of Sperm

Taking From Sires." On its basis the pedigree stock association receives every month a "Report on the Production Laboratory" with monthly (quarterly, annual) data for every sire on the number of ejaculates, their average volume, concentration, activity, rejects before freezing and rejects (doses) after freezing, number of prepared doses and frequency of dilution of the sperm, and its suitability for freezing. These data are calculated separately for every group of bulls assigned to herdsmen and sperm taking technicians and for the pedigree stock association as a whole. Furthermore, the same information can be issued for every breed and for individual lines of animals within the limits of a breed.

At the same time, the input document of the production laboratory serves as a source of information for the formation of a bank of data on the spermotheca on the basis of an automated recording of the number of sperm doses transferred for storage.

The automated management of the spermatheca is carried out according to the information of input documents "Sperm Utilization" and "Arrival of Sperm" (for that purchased elsewhere), which makes it possible to obtain a "Spermatheca Report" on the monthly, quarterly, and annual sperm movement for every sire, breed, line, and the spermatheca as a whole, as well as information on the availability of the sperm of individual bulls with an indication of the number of the storage facility and section. Furthermore, the pedigree stock association can receive a machinogram, which should serve as the basis for the presentation of bills to specific farms for the sperm and citrate nitrogen received.

The automated management of the bank of data on the growth and development of eleveur [stockbreeder] bulls with the issue of information on the causes of withdrawal and recommendations for the culling of bulls according to the indicators of the rate of growth of animals and the quality of their sperm production (according to the first 10 ejaculates) is also carried out within the framework of this system.

The institute also has solved such an important problem as the automated selection of pairs based on the input of information on the utilization of sires in the last 10 years, comparison of the quality of dams of a certain herd and of the quality of sires, and prohibition of the degrees of inbreeding established by the program. The computer issues an optimized variant of assignment of sires on every farm, a list of farms, where for part of the stock of cows it is necessary to bring the sperm of sires from another pedigree stock association, a calculation of the possible genetic improvement, a plan for the rotation of lines for a 10-year period, and so forth to each pedigree stock association.

On the basis of the modification of N. Z. Basovskiy's and V. M. Kuznetsov's methods (1982) with due regard for the volumes of crossing of cows with Holstein-Friesian bulls an optimal variant of the program for the selection of dairy cattle according to the rate of growth of animals has been developed.

The collection of initial data received on each individual animal from input documents ("Offspring Act," "Record of Weighings and Weaning of Young Stock,"

"Report on Herd Reproduction," and "Inventory of Withdrawn Animals"), which make it possible to obtain full information on the results of utilization on the farm of sires, cows, and young stock, also forms the basis for the system of selection control in beef cattle raising. On the basis of processing of the data received a record of raising and recommendations for the weaning of young stock with its distribution into groups (pedigree, commercial, and rejects) and some other information necessary for an operational control of the selection process are issued to farms; in particular, an inventory of cows with an evaluation of their pedigree value according to the weaning live weight of offspring, whose algorithm takes into account sexual dimorphism according to the live weight and the calving number, as well as an inventory of primapara cows with an evaluation of their selection index according to the weaning live weight of offspring, the live weight of the cow itself, and the length of the service period as an overall indicator of its reproductive capacity.

At the same time, the final formula for the calculation of the selection index of a separate cow takes the following form:

$И=0.3499\ (X_1-210)+0.4873\ (X_2-490)-0.2388\ (X_3-80)$, where 0.3499; 0.4873 and 0.2388 are the weight coefficients of the values of characters;

X_1 is the actual live weight of a calf during weaning corrected for sexual dimorphism;

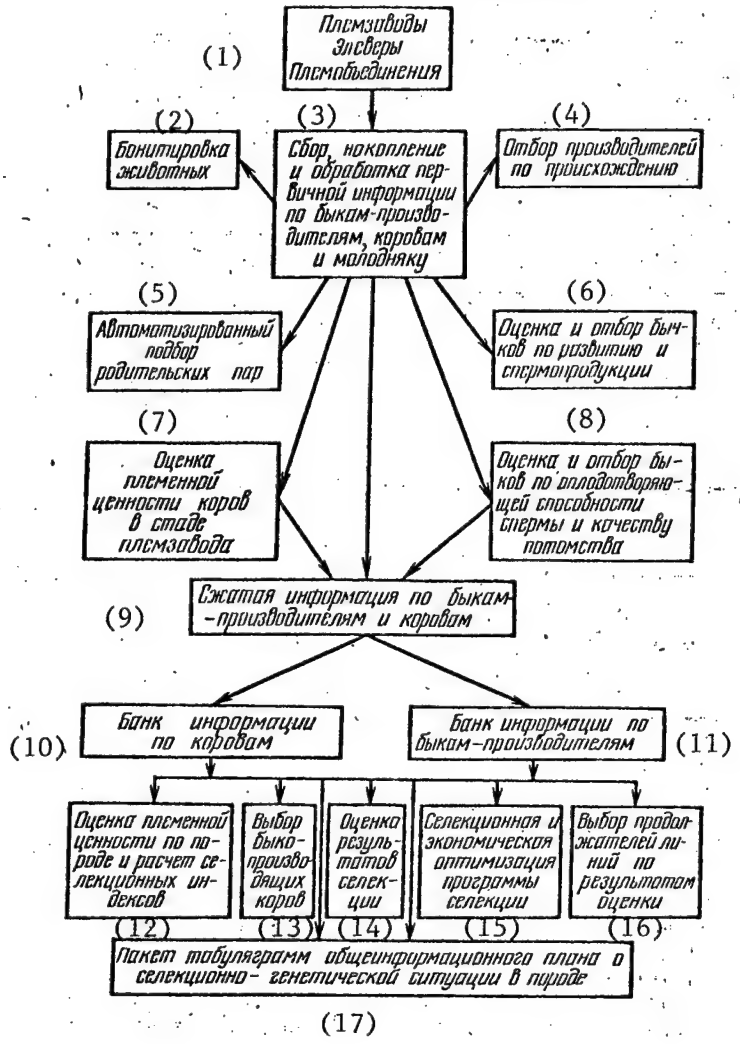
X_2 is the actual live weight of a primapara heifer;

X_3 is the actual length of the service period;

210, 490, and 80 are the corresponding standards of characters.

An algorithm of the calculation of a program for the selection of beef cattle has been worked out for the first time and a method of preparation of input parameters has been developed. The milkiness of cows according to the live weight of offspring during weaning at the age of 8 months and the increase in the live weight of young stock have been taken as the main selection characters, according to which an evaluation of genetic progress is made.

An automated card file of sires and cows intended for obtaining bulls on a republic scale, as well as a system for operational control of the reproduction of the breeding herd within the limits of a rayon with the use of the technical base of the rayon information computer center, is now being developed.



Data Base Organization and Support for the Selection Process

Key:

1. Pedigree stock plants
   Eleveurs [stockbreeders]
   Pedigree stock associations
2. Classification of animals
3. Collection, accumulation, and processing of initial information on sires, cows, and young stock
4. Selection of sires according to origin
5. Automated selection of parental pairs
6. Evaluation and selection of bulls according to development and sperm production
7. Evaluation of pedigree value of cows in the herd of a pedigree stock plant
8. Evaluation and selection of bulls according to the fertilizing capacity of the sperm and quality of offspring
9. Brief information on sires and cows
10. Bank of information on cows
11. Bank of information on sires
12. Evaluation of pedigree value according to breed and calculation of selection indices

13. Selection of bull producing cows
14. Evaluation of selection results
15. Selection and economic optimization of the selection program
16. Selection of continuers of lines according to the evaluation result
17. Package of printouts of the general information plan on the selection-genetic situation in a breed

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DEVELOPMENT OF ARM FOR PLANNING WORKERS DISCUSSED

Moscow MASHINOSTROITEL in Russian No 3, 1986 pp 34-35

[Article by G. G. Globa: "Automation of Planned Calculations Under Conditions of the Economic Experiment"]

[Text] Under the conditions of the economic experiment increased demands are placed on the automation of planned calculations and automated enterprise management systems (ASUP). Several stages in the automation of planned calculations in ASUP have been executed by now: performance of individual calculations, execution of sets of calculations, and solution of problems of planning in ASUP subsystems. However, with the existing method of automated data processing the technology of performance of planned calculations does not enable the planning worker to promptly take into consideration a number of factors important during the organization of planning work (for example, current management instructions, changing supply and sale conditions, personal experience and initiative of the planning worker, and so forth). Variant and optimization calculations have not been used properly in planning to this day, which is connected with the insufficient preparation of economic managers and planning specialists for this, lack of the necessary correspondence of economic and mathematical models to real planning processes, and imperfection of software.

These problems can be solved as a result of the creation of automated work places (ARM) for economic planners, which will make it possible to ensure an interactive mode of operation with a computer during the execution of planned calculations, an immediate access of planning workers to the necessary information, and its reception in a form convenient for making prompt and qualitative planning decisions. At the same time, ARM take into account the requirements of all categories of users of planning information.

At the level of higher-link managers (enterprise director and his deputies) planning decisions are made on the basis of the aggregation of information, which is of a generalized nature, defining the state of the entity of management as a whole. Simplicity of work with the terminal, reception of aggregate information and, at the same time, the possibility of its detailing, and presentation of information in the form of tables are the basic requirements on ARM. Medium-link managers (specialists of functional subdivisions and chiefs of divisions and shops) require more detailed data in

planning information and the scanning of its big files. Lower-link management workers execute the simplest operations on the input, processing, and reception of required data with the terminal. Professional users possess special knowledge and, therefore, execute any procedures during work with a computer system.

Consideration of the requirements of users of the indicated categories makes it possible to single out a number of functions, whose automation will make it possible to raise the question of the creation of ARM for planning workers. These functions include the following: control of the course of the computer process according to the user's wish depending on intermediary results; correction of any data in the process of work; reception of information on corrections, composition and values of input data, results of calculations according to different variants, and so forth on request; reception of resultant indicators of planned calculations in the form of paper documents; communication with the computer system in a language close to the professional language of a specific user; interaction with other planning workers during the execution of calculations.

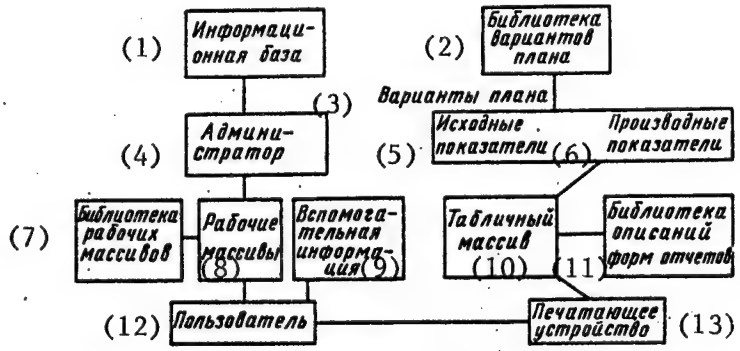
Experience shows that, in order to develop ARM for planning workers, it is necessary to solve problems connected with hardware, data base organization and support, software, and technological support for ARM. Hardware represents a set of equipment connecting the work places of specialists with the computer and helping them to execute their functions better. Since ARM are determined by the functions executed by them, it is most convenient for planning workers when ARM are connected with the computer by alphanumeric displays with documenting devices.

Data base organization and support for ARM for planning workers are connected with the creation of an information base (see diagram), that is, a base for initial information (standard, statistical, planning, reporting, and so forth) used during the execution of calculations. For the purpose of ensuring the integrity and safety of the information base, the user planner can affect it only through the administrator. When executing calculations, the user uses work information files received on request. Often they are stored in the work file library. In the process of work the user refers to the appropriate auxiliary information stored in the archives.

The variant or fragment of a plan includes initial and derived indicators (determined from initial indicators according to appropriate algorithms: If according to simple algorithms, plan variants can include only initial indicators). The worked out plan variants or fragments are entered in the library of plan variants used in subsequent work. In the process of work it is convenient for the planning worker to receive information in the form of a paper document. All information is stored in the library of descriptions of forms of reports and, when the necessary form is requested, a tabular file containing information on a description of the required form is created.

Functional software for ARM for planning workers envisages the solution of planning problems and software for the interactive operating mode. Functional software realizing a certain mathematical method of solving an appropriate planning problem and oriented toward a narrow class of economic-mathematical

models has now become most widespread. This does not meet the user's requirements from the point of view of completeness and consideration of specific conditions of planning. The creation of programs ensuring a setting not only to the economic-mathematical model of a specific user, but also to the information base of this model, is promising.



Key:

1. Information base
2. Library of plan variants
3. Plan variants
4. Administrator
5. Initial indicators
6. Derived indicators
7. Library of work files
8. Work files
9. Auxiliary information
10. Tabular file
11. Library of descriptions of forms of reports
12. User
13. Printer

In programming languages there are means of communication with displays for an interactive operating mode during the execution of planned calculations, but they realize minimal communication capabilities. The organization of interaction of the user with quite complex problems through displays by these means alone is highly labor intensive. The set of interactive operating mode programs offers additional means for an organization of work in this mode, which include a special dialogue language--language of description of a scenario and a program organizing a dialogue in accordance with the scenario. The dialogue language ensures the user's interaction with the computer system in the terms and concepts of the appropriate subject area, that is, in a language close to the professional language of a specific user--in this case, of the planning worker.

The utilization of the directive form of language, in which a detailed diagnosis of errors and the issue of recommendations concerning further actions are inherent, is one of the most convenient methods of interaction with the computer system operating in an interactive mode. It allows two types of dialogues: active on the part of the computer system and active on the part of the user. In case of a dialogue active on the part of a computer system at every step certain actions, which the system can execute, are offered to the user for selection and information on how the user should

answer, so that the system may recognize what action has been selected, is provided. Depending on the user's answer the computer system either executes the requested actions, or asks the user a new question to clarify his requests. If the user knows how to express his thought accurately in the form of a directive, he uses constructions established by the dialogue language for this.

Texts forming part of the dialogue, which are output to the display screen, are given in the language of the scenario by means of models. "Windows" of the model--fields designed for entering information in the process of operation of the dialogue program--are marked by brackets.

For example, the following model lights up on the display screen:

```
        INTERACTIVE MODE SET OPERATES
        POSSIBLE OPERATING MODES:
[ ]     1. DATA SCANNING
[ ]     2. DATA CORRECTION
[ ]     3. CALCULATION OF PLANNING INDICATORS
        MARK THE SELECTED MODE WITH THE SYMBOL
        "Exclamation mark"
```

The user brings the cursor to the model window, which determines the selected operating mode, and presses the "!" key. If the user must fill in several windows, the cursor is brought to the first window designed for information input, after which it is moved to the next window and so forth until all windows are filled in. After an entry is made in the last window, the card with the parameters inserted in it is read and transferred to the dialogue program for processing. If an error is detected during the execution of the dialogue program, information on it is transferred to the screen. The user must repeat the answer correctly, or give an instruction, setting one of the following commands in the dialogue language: transfer control to the beginning or to the indicated place of the dialogue; finish the execution of the dialogue; return to the beginning of the step; ignore the error and proceed to the execution of the next step; transfer control to the indicated label. The user can set the same commands on his initiative at any moment in order to change the course of the dialogue and, thus, to realize its form active on the part of the user.

In addition to the organization of the response to an error and the transfer of control to any dialogue label, the user is given quite extensive opportunities to control the dialogue. If necessary, a printout of the protocol of work and input of control parameters is included. If the user does not know how to interact with the system correctly, he can request help. The reference service of the dialogue meets the requirements of both beginning and experienced users, that is, they can ask the system a question about subsequent actions if the heretofore received explanation is unclear.

The existence of dialogue means largely determines the efficiency of ARM operation. The general control of the dialogue process, communication with the user, processing of error situations, and reference service are realized. The creation of ARM for economic planners for the performance of planned

calculations in an interactive mode will ensure their direct interaction with the computer system and the elaboration of optimal management decisions.

The introduction of ARM for planning workers enhances the role of planning as the most important economic method of management, because they make it possible to a certain degree to intensify the process of planning, to improve its methods, adapting them to modern conditions, and to expand the economic analysis of adopted plans. The dialogue successfully combines the abilities of the planning worker for an informal solution of problems based on his knowledge and experience with the computing capabilities of the computer.

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APPROVAL AND EXPERIMENTAL OPERATION OF INTERSECTOR STANDARD DESIGN SOLUTIONS

Moscow VESTNIK STATISTIKI in Russian No 5, May 86 pp 52-55

[Article by N. Tuz, deputy director of Computer Center of Minskoblmashinforma, BSSR Central Statistical Administration, and G. Zhukovskiy, chief design engineer, Belorussian Branch, VNIPIucheta, USSR Central Statistical Administration]

[Text] An extensive program for development of intersector standard design solutions (TPR) and applications program packages (PPP) for automation of bookkeeping using the latest computer hardware has been confirmed to implement the task of improving the organization of bookkeeping and of increasing its role in efficient and economical use of the material, labor and financial resources by the USSR Central Statistical Administration, upon coordination with the USSR Ministry of Finance. One of the leading positions in the indicated program is allocated to development of standard design solutions for centralized bookkeeping offices of budget institutions: working our unified standard designs of education, health and cultural systems for institutions using YeS and SM 1600 compurers and Robotron and Iskra microcomputers is provided. The applications program packages that implement the main design solutions are intended for computer centers and stations of the USSR Central Statistical Administration system. The quality of contract-detail designs and of software is of important significance.

The Belorussian Branch, VNIPIucheta [possibly All-Union Scientific Research and Design Institute for Accounting], worked out the Intersector standard design solutions for budget institutions using YeS computers. The Minsk Regional Department of the Intersector Fund of Algorithms and Programs for Bookkeeping and Accounting (MOFAP Bukhgalterskiy uchet) has been organized at this branch. According to its functional designation, the standard design solutions and program documentation serve as working documents and are used for specific central bookkeeping offices of education, health and cultural systems, essentially without modification, regardless of the volumes of the accounting and economic information, departmental subordination, sector affiliation and organizational structure of the budget institutions. Complete implementation of the concepts of the machine-oriented form of budget accounting, development of a system of automated accounting data processing in the part of the complexity, adaptability, information integration, functional and procedural selectivity, functional reliability, high degree of technological effectiveness and also minimization of the cost of tie-in and introduction of developed data processing systems, has been provided in this regard in the standard design solutions and applications program packages.

The efficiency of the software is usually checked on a test example when developing individual or standard designs. The volume of the test example is not regulated in any way and all the versions of input, correction, checking and processing online and normative reference information, makeup of workers, intermediate and storage machine database files are provided in it and output documents, i.e., all the algorithms, also cannot be printed out. The design documenation and software are frequently turned over to the client for determination and elimination of deficiencies during experimental operation. This procedure is regulated by sector-wide guidelines and methodical materials for design and development of ASUP [Automated enterprise management system].

The relationships of the parties participating in introduction of the design are regulated by confirmed procedural and normal documents.

With massive use of the developed designs and programs, one does not have to count on modification of individual regulations and elimination of the comments or implementation of the suggestions and recommendations of the executor (computer center) and client (central bookkeeping and accounting). The design should be within the functional sphere, worked out according to all procedures and should correspond to a specific scientific and technical level. To do this, the standard design solution and applications program packages should be approved at individual or at several facilities of each sector or department (organization). This step, completely different from experimental operation, is necessary, although it is complicated with respect to organizational-technical and legal relations.

For a higher quality test and completion of standard design solutions and applications program packages, it was recognized that they could be approved in the central bookkeeping and accounting office of each of the education, health and cultural ministries.

It should be noted that the standard design solutions to be worked out were considered and reviewed by the union and republic ministries of education, health, culture and finances and also by specialists of Soyuzmashinforma [not further identified], USSR Central Statistical Administration and the head department of VNIPIucheta, USSR Central Statistical Administration. The basic aspects of the design were considered by an interdepartmental commission.

All the aspects of the design were selected on the test example, compiled by the designers and filled out by hand for both input and output information. Therefore, the decision was made to carry out the approval in the centralized bookkeeping and accounting offices attached to Minpros BSSR [BSSR Ministry of Education], at the Administration of Culture, Mingorispolkom [Executive Committee of Minsk City Soviet of Working People's Deputies], the Oktyabr Regional Health Department of the City of Minsk at the Computer Center of the Minskoblmashinforma, BSSR Central Statistical Administration, after the applications program package had been developed for each combination of tasks and after results had been obtained on a test example. Selection of the basic central bookkeeping and accounting offices and the computer centers was not accidental. One the one hand, the enumerated central bookkeeping and accounting offices are related to different departments and serve budget institutions included in organizations at different levels of management. Moreover, each central bookkeeping and accounting office has its own characteristic features of management of bookkeeping by separate sections.

Deficiencies were determined in the software during approval and the recommendations and proposals to improve the formulation and content of the design documentation, software and technology of information preparation and processing were taken into account. Methodical problems on management of mechanized and automated accounting in the central bookkeeping and accounting offices were solved at the same time. The input, correction and monitoring systems and programs of online and normative-reference information were analyzed. Specialists of the comptuer center made a number of suggestions to improve the applications program packages. Thus, an arithmetic check of the correctness of transfer of information to machine carriers with computation of check sums by variable requisites within a batch of primary documents was realized by program. The information in the check protocol was printed according to the key requisites (institutions, cable numbers and so on). This caused inconveniences in determination of erroneous records. An additional check within the batch with computation of check sums by multiline documents and printing of information in the protocol unsorted, i.e., in the course of tracking the records in the document, were introduced. This reduced considerably the labor expenditures, related to checking the information after it was entered in the computer. Paper consumption for check tables was also reduced.

The technology was improved at the computer center during approval. The information input and correction system, specifically, was improved. The number of functional modules was reduced in some applications program packages and the programs were combined at the procedures level, which made it possible to automate the process. The developer was required only to describe in more detail the operator's actions in case of emergency completion of procedures.

Specific measures to preserve information were determined, for which special procedures were developed that permit one to copy stored data sets from disk onto magnetic tape and to restore them if need by from magnetic tape to disk. These and a number of other observations and proposals introduced by the workers of the computer center permitted a significant reduction of machine time expenditures in the phase of introduction and correction and a reduction of the cost of information processing for the central bookkeeping and accounting offices of budget institutions. The bookkeepers made suggestions to improve the coding system of separate requisites, computation algorithms and printout of documents.

The corresponding ministries and departments made changes in the instructional materials for individual types of calculations when working out the standard design solutions and applications program packages and the developers and programmers corrected the standard design solutions and applications program packages during approval. Thus, changes in the order of computations for maintenance of children in preschool institutions, changes related to an increase of teacher wages in general education schools and so on were reflected. All the introduced corrections in the software were finished and verified immediately.

Conferences and days of quality, conducted with obligatory participation of all parties, played an important role in approval. It must be noted that the workers of the central bookkeeping and accounting offices of the ministries of education, health, culture and finance of the republic and also of Belmashinforma [not further identified], BSSR Central Statistical Administration, rendered the designers and central bookkeeping and accounting offices important practical assistance in developing the design solutions.

Further approval of intersector standard design solutions and applications program packages was conducted at a number of computer centers and at the central bookkeeping and accounting offices of other cities in the country, which made it possible to work out new aspects of the design at the proper scientific and technical level due to the broad scope of the different types of institutions. The intersector standard design solutions and applications program packages were considered by an interdepartmental commission after experimental operation and they were recommended for confirmation and transfer to MOFAP Bukhgalterskiy uchet [not further identified].

As experimental operation of individual combinations of tasks is completed and as experience is accumulated in management of machine information processing, the central bookkeeping and accounting offices rejected duplication of manual accounting or data processing according to its separate sections on ther types of computers. The combination of problems "Accounting according to special types of payments" at the central bookkeeping and accounting office attached to Minpros BSSR and the central bookkeeping and accounting office attached to the Administration of Culture, Mingorispolkom, was primarily turned over for industrial operation. Industrial operation of the complex of problems "Bookkeeping and accounting of food products" was then begun in the central bookkeeping and accounting office attached to Minpros BSSR and the central bookkeeping and accounting office of the Oktober Regional Health Department. The information began to be processed on computers according to the accounting of material valuables.

The work was conducted simultaneouslyfor all three central bookkeeping and accounting offices. Moreover, the total volume of information was used for the indicated complexes of problems, i.e., data for all institutions. The calculations for wages were initially made for several institutions of each central bookkeeping and accounting office with manual duplication over a period of 2-3 months. All the remaining institutions were then included, having replaced the calculations which were earlier done manually. The documents for calculation of finance-accounting operations, cashbox and actual expenses were transferred last for machine processing. The output document "Balance of execution of expense estimation," which the computer also prints out for the central bookkeeping and accounting offices, serves as the final document for the entire machine-oriented form system.

Thus, all the combinations of problems are already functioning in the industrial mode at the basic central bookkeeping and accounting offices of the education, health and cultural systems.

The approved software and technical documentation from MOFAP are turned over to the computer centers and central bookkeeping and accounting offices of the republic and to many of the country's cities. It should be noted that no additional instructions had to be worked out at all at the central bookkeeping and accounting offices and computer centers. The standard operating documentation was considered the working documentation at all phases of the production process. Introduction of machine processing of the information of budget institutions according to the new standard design solutions permitted a significant reduction of the laboriousness of computations and management of bookkeeping and accounting at the central bookkeeping and accounting offices. All arithmetic operations were

turned over to the computer center. There was no need to sort or group documents according to specific requisites, to carry bookkeeping operations by accounts and to manage the registers of analytical and synthetic accounting. The machine records contain the necessary data for all operations of economic activity of construction subdivisions (institutions and departments), serviced by the central bookkeeping and accounting office.

As a result, the laboriousness of manual operations of the bookkeepers of the central bookkeeping and accounting office decreased by 50-60 percent. Timewas freed for checking and analysis of economic operations and for intensification of check functions over expenditure of budget funds.

The annual saving due to introduction of integrated automation of budget accounting at one central bookkeeping and accounting office comprises an average of 2,500 rubles. The use of machine records as accounting registers made it possible to do away completely with management of different grouping and storage information, bookkeeping ledgers and memorial orders at central bookkeeping and accounting offices. The so-called "memorial-order format of accounting" was converted to a completely new, machine-oriented format. A unified technology of management of accounting was organized and the unity of the methodology and organization of the entire accounting system at different institutions of different systems and departments according to the type of activity, functional designation and organizational structure was also provided.

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TRENDS IN IMPROVING PLANNING DATABASE IN MINISTRIES AND AGENCIES

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 1-4

[Article by Candidate of Technical Sciences N.N. Fedotov (GNITsVOK) and Candidate of Economic Sciences V.A. Zverev (Gosplan SSSR), under the "ASU SOFTWARE. GENERAL PROBLEMS OF CLASSIFICATION, CODING AND USD" [Unified System of Documentation] rubric]

[Text] Nowadays, computer technology is being actively implemented in various manufacturing and management spheres, and development of the latest means for computerized information processing industry has been scheduled, as well as further development of work on application of automated systems at all levels of management (including planning), based on integration of these systems and wide use of local computer networks and automated workstations.

Therefore, the work on improving planning, using computers, must make provisions for the following:

development of technical means for planning and improving planning techniques, based on application of local computer networks and personal computers and on creation of automated workstations;

improvement of information service for planners by developing a common planning database for all levels and sections of management and development on its base of information reference systems and local databases;

providing integration of calculations of ministries' and agencies' ASU, that have a common database and use local computer networks.

It is necessary to improve the technology not only in manufacturing, but also in management. Therefore improvement of information processing technology in planning agencies is one of the directions of improvement of planning.

Improvement of technology should be based on local computer networks and automated workstations, based on mini- and personal computers, compact and simple, as far as their operation is concerned, that are becoming the nucleus of flexible automation systems.

Simplicity and functional flexibility of dialog software for personal computers make them affordable for a mass user.

Today, in computer centers of USSR ministries and agencies, a basically centralized information processing system, based on macrocomputers of YeS EVM type, is in place. With this mode of operation, the operativeness of information processing of a number of planning tasks (especially annual planning tasks) does not always satisfy a planner's requirements.

Implementation of minicomputers in ministries and agencies made it possible for professionals to solve problems in the dialog mode, which considerably improved the operativeness of information processing. But at the same time, it is difficult to perform on minicomputers calculations, that require large volumes of information.

In the 12-th five-year plan, development of local computer networks and automated workstations will make it possible to widely use for planning a distributed data processing system, that uses mini- and macrocomputers.

The objectives of development of local computer networks are: rational utilization of computers for calculations, increasing the workload of minicomputers, improving the timeliness of planning information processing, ensuring integration of calculations within divisions of an automated local network.

Automated planners' workstations, which make it possible to solve planning and analytical problems and to process text information, using personal computers, must become basic components of local computewr networks.

In creating automated workstations in ministries and agencies, one should determine the demand of professionals at all levels for information, required for efficient performance of functions, related to development of plans and to performing analytical calculations. Then one must select hardware for processing digital and text information and develop economic, organizational and administrative measures, that facilitate management's job.

To integrate automated workstations based on personal computers, it is necessary to establish a unified method for data presentation and a common working style of users, as well as provide for simple switching from one type of operation to another, for instance, from word processing to inputting tabulated data and to performing calculations.

Ensuring integration of automatic management systems of ministries and agencies is possible, if one uses for calculations a common planning database on machine media.

A database must be common for all levels of planning. This means, firstly, providing uniformity of methods and informational compatibility of data, and secondly, integrating all data from different sources.

Now, a database for solving planning problems has been developed, but the information, contained in it, makes it possible to only solve a certain range of problems for specific subsystems. Organization of intersubsystem complexes of information reference systems, wherein it is necessary to use for calculations information from various subsystems and various planning levels,

calls for the development of a common database.

Besides, creation of databases for specific automated workstations for professionals at various planning levels (from department heads to economists) requires coordination of these databases with the common database.

Therefore a big job is in store to ensure informational and technological compatibility of problems in various subsystems, when using common system information (Unionwide classifiers, unified dictionaries, unified nomenclature), as well as compatibility of local databases in minicomputers with the centralized database, that is being developed in computer centers.

Solving information-reference problems for professionals at different levels also calls for concentration of large information files, putting them in order and providing on-line search and retrieval of necessary information.

It is only on the base of a well developed technology of distributed data processing systems, that it is possible to start the development of local information reference databases for respective management levels.

Development of efficient technology of operating with centralized and local databases will not only make it possible to simplify the control of the entire system and to improve its reliability, but also to ensure more efficient interaction between agencies, individual subsystems and problems and to improve the quality of plans, that are being developed, and of management decisions.

It is necessary to develop models of interrelated local databases of a multilevel system of planning calculations and an informational model of the system of indices of State plans for the economic and social development of the USSR.

Dissociation of agencies often hinders efficient utilization of computers for transmission of data on machine media. Currently, only internal links between ASPR [automated control system for planning calculations (under Gosplan)] complexes of problems have been debugged, but elements of interrelation with information from OASU [automated control system for a sector of industry] are hardly developed. All experiments on interaction with OASU, that have been conducted, had only to do with transmission of the same data, contained in unified planning and reporting documents, presented in specified formats on magnetic tapes. But this is only one of the elements of interaction. Another direction is providing access to databases of ministries and agencies in solving problems of large intersubsystem complexes, such as the Unified System for Capital Construction Planning, Integrated Complex of Balance Calculations, Unified Nomenclature of Products, Scientific and Technical Progress etc.

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STANDARDIZATION OF METHODS FOR APPLICATION OF COMPUTERS IN MANAGEMENT SYSTEMS (AS A MATTER FOR DISCUSSION)

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 5-8

[Article by Doctor of Technical Sciences V.A. Gerasimenko (MGIAI) under the "ASU SOFTWARE. GENERAL PROBLEMS OF CLASIFICATION, CODING AND USD [Unified System of Documentation" rubric]

[Text] Improvement of management in all spheres of national economy calls for the search and implementation of principally new approaches to understanding the nature and organization of management and to providing management. Formation of these approaches must be based on the analysis of the most essential features of modern management, such as its mass character, continuity, and a highly dynamic character of the process, as well as its significance. Therefore a management mechanism must be regulated and must guarantee a certain minimum level of management. These requirements are met by industrialization of management, i.e. by putting it on a straight-line-flow-industrial basis.

Industrialization of management also assumes complex automation of information processes and the maximum possible unification and standardization of all decisions, related to application of computers in management systems.

The very concept of standardization of decisions, related to application of computers in management, is complex and multifaceted. In order to ensure general industrialization of management and standardization, it is necessary to revise the following:

prinicipal provisions of the general concept of complex automation of data processing and management processes (conceptual standardization);

architectural construction of complex automated management systems (architectural standardization);

principles and methods for unification of automated information processing procedures (procedural standardization);

technological diagrams of functioning of complex automated management systems (technological standardization);

principles and methods for the development of complex automated management

systems (design standardization).

Conceptual standardization is standardization of the contents and interpretation of the contents of the entire set of problems, that form the base of the concept of computers application in management systems. Such concept can be defined as a system of views on the following problems:

objectives of computers application in management systems;

the definition and contents of complex automation of data processing in management systems;

the place and features of complex automation in the overall process of developing means and methods for and forms of automation of data processing in management systems;

the importance of complex automation of management systems for improving the developed socialistic society;

sources and indices of and methodology for assessing the efficiency of complex automation of management systems;

general methodological principles of complex automation of management systems.

Up till now, the problems of conceptual standardization have not been presented in an explicit form, which is one of the most important reasons for insufficiently high efficiency of existing and newly developed ASU. And transition to complex automation without conceptual standardization is impossible in principle.

Architectural standardization implies the development and implementation of standards for organizational, functional and structural construction of complex automated management systems. By now, a significant number of standards on various aspects of architectural construction of ASU have been developed. However, all existing standards are based on the so called problem-by-problem approach, the essence of which is that an ASU is created for automated solution of a fixed set of fully functionally defined problems. This approach has been recently subjected to serious criticism, because it does not conform to the complex automation concept, the essence of which is creating conditions for automated performance of all information processing procedures, that arise in the process of management. This approach calls for considerable changes in architectural construction of automated systems. Besides, collective-use computer centers (VTsKP) have been ever widely used recently. Basing an ASU on VTsKP resources, rather than creating one's own VTs, has a number of advantages, but it has not been reflected in existing standards either.

Procedural standardization implies the development and implementation of standards, that regulate automated information processing procedures. In this case, we are not talking about standardization of methods for automated solving of functional problems, which are formed when an ASU, based on the problem-by-problem approach, is developed, but rather about standardization of

those procedures, that are necessary and sufficient for ensuring complex automation of data processing in management systems. For this purpose, one has first of all to define a canonized set of procedures, that can ensure complex automation in a general case of management, and then accomplish the systemic and standard realization thereof, i.e. such standardization, which takes into account all demands for these procedures and which is optimal, as far as modern means and methods for automated information processing are concerned.

Information processing procedures, that are necessary for complex automation, can be represented by three classes: informational procedures, logical-analytical procedures and procedures for search of optimal solutions. Taking this into account, the principal contents of procedural standardization will be comprised of system standardzation of attributes, required for automated performing of all procedures in each of the above mentioned classes.

The objective of technological standardization is to develop unified technological diagrams for automated information processing in management systems, which would make it possible to implement principles of industrialization of management, while at the same time providing optimum utilization of resources of management systems. Nowadays there are objective prerequisites for the development of a unified industrial technology for automated management, in regard to which management technology in each individual system will be a particular case. In this case, the problem of technological standardization can be concretely defined as the development and implementation of industrial technology for automated management. The development of such technology does represent the implementation of management industrialization methods and principles.

Lastly, design standardization implies the development of a standard and sufficiently efficient methodology for the development of complex automated management systems. Because an industrial technology for automated management is assumed to be a "submersing environment" for any conceivable management technology in a specific system, objective prerequisites are being created for reducing the development of an automated management system for any specific system to generating its technology from general industrial technology. The objective of design standardization is to develop a technology generator and attributes required for debugging, organization and ensuring the functioning of the automated management technology as a derivative of industrial technology.

Thus, not only does standardization of methods for computers application in management systems in the discussed presentation create prerequisites for industrialization of organizational and economic management, but it also creates conditions for the development of automated management systems on a straight-line-flow-industrial basis, which provides the following:

automatic creation of conditions for mating automated management systems in any direction and on any scale;

drastic reduction of labor content of, time for and cost of developing automated management systems;

creating conditions for mass-scale development of automated management systems on a high scientific, technical and professional level;

conditions for purposeful management of the activity and expansion of automated management systems.

Implementation of the above discussed methods and principles will make it possible to solve multifaceted management problems at a qualitatively new level, which is required at the current stage of development of the Soviet society.

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FEATURES OF STRUCTURE OF ASSORTMENT SECTION OF CLASS 35 OF OKP [UNIONWIDE CLASSIFIER OF INDUSTRIAL AND AGRICULTURAL PRODUCTS] "CABLE PRODUCTS"

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 9-11

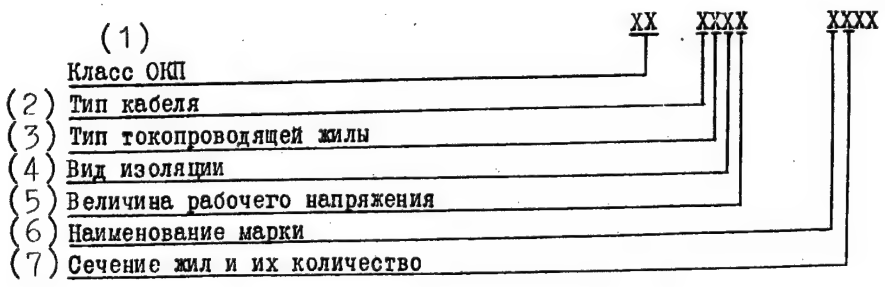
[Article by Z.G. Kozina, T.N. Abramova (GNITsVOK), M.A. Popkov and A.P. Buryak (VNII Standartelektro) under the "DEVELOPMENT AND IMPLEMENTATION OF CLASSIFIERS AND USD" [Universal System of Documentation] rubric]

[Text] A specific feature of products, coded in class 35 of the OKP, "Cable Products", is a large number of modifications of the same type. In order to reduce the volume of the standard and to simplify the search for items, special tables were compiled, which can help to easily identify a ten-digit code from the combination of parameters of the required modification.

Use of the tables in the assortment section of class 35 of the OKP made it possible to reduce several-fold the volume of individual sections.

Analysis of cable products nomenclature showed, that design and technological features of the majority of cable types can be completely reflected by the first eight digits of the OKP ten-digit code, and these eight digits define the brand and the function of a cable. The ninth and tenth digits of the code only identify the number and cross-sectional area of cable conductors, i.e. a cable size. As an example, we can examine classification of power cables with impregnated paper insulation, manufactured in accordance with GOST 18410-73 "Power Cables with Impregnated Paper Insulation. Specifications" and having 63 brands, each having 83 sizes.

The ten-digit OKP code structure has the following form:

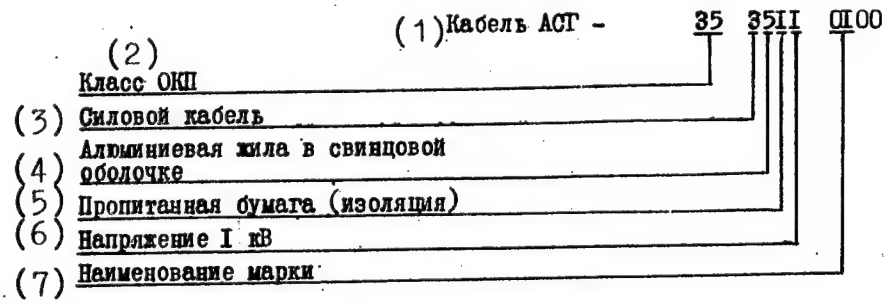


(See key on following page)

Key:

1. OKP class
2. Cable type
3. Cable conductor type
4. Insulation type
5. Operating voltage
6. Brand name
7. Cross-sectional area and number of cable conductors

For a particular cable brand, the first eight OKP digits carry the following information:



Key;

1. ASG cable
2. OKP class
3. Power cable
4. Aluminum conductor in lead sheath
5. Impregnated paper (insulation)
6. 1 kV voltage
7. Brand name

The code for a specific size of ASG cable is formed by replacing zeros in the ninth and tenth digits with appropriate values from the following table:

Ninth and Tenth OKP Code Digits	Number and Cross-Sectional Area (mm^2) of Cable Conductors
01	1 x 10
02	1 x 16
03	1 x 25
--	--
--	--
83	4 x 120

Thus, the OKP code of ASG 1 x 10 cable is 35 3511 0101, and that of ASG 4 x 120 cable is 35 3511 0183.

If the number of cable or wire sizes exceeds 99, then other structures of classification organization in the seventh through the tenth digits are used. For instance, the seventh and eighth digits can specify the brand with certain additional parameters.

AVVG cable, GOST 16442080 "Power Cables with Plastic Insulation. Specifications", for 1 kV voltage, with a grounding conductor:

35 377I 5200
└ AVVG cable with a grounding conductor;

AVVG cable, GOST 16442-80, for 1 kV voltage (with main conductors):

35 377I 5300
└ AVVG cable with main conductors.

The ninth and tenth code digits can be taken from the tables.

Because there are more than 99 sizes of the AVVG cable, five tables were developed: for 1 kV voltage with a grounding conductor; for 1 kV voltage with main conductors; for under 1 kV voltage; for 6 kV voltage; for 10 kV voltage.

Use of the table method for coding electrotechnical products made it possible to considerably reduce the cost of paper for printing class 35 A-OKP and technical standards documentation (State and industry standards and specifications) for products, containing OKP codes. It is especially important for cable types with a large number of sizes. Technical standards documentation for shipment of these cables, compiled without using the table method, would have had dozens, and sometimes hundreds of pages of text.

The table structure of the assortment section makes it possible to ensure rapid entering of changes into the A-OKP by replacing sheets and the speedest providing the information on these changes to subscribers, involved in planning, pricing, standardization, supply and selling of products.

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DEVELOPMENT OF 47 3798 AND 47 3799 CLASSIFICATIONS OF A-OKP

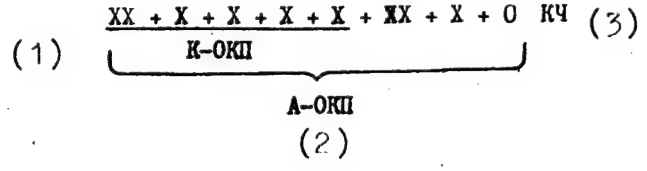
Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 11-12

[Article by T.M. Pshenichnaya (GNITsVOK) and N.N. Kapitonenko (GVTs, USSR Minbumlegprom) under the "DEVELOPMENT AND IMPLEMENTATION OF CLASSIFIERS AND USD" [Universal System of Documentation] rubric]

[Text] The assortment sections of OKP (A-OKP) for 47 3798 ("Tooling and Equipment for Tapping and Hand Tools for Extraction of Resinous Wood") and 47 3799 ("Tooling and Equipment for Wood Tar and Turpentine Production") classifications have been developed.

Structurally, these classifications consist of two parts: classification (K-OKP) and assortment (A-OKP).

The codes structure formula in the complete (assortment) nomenclature is



Key:
1. K-OKP
2. A-OKP
3. KCh

Classification parameters are arranged in the following order:

two digits (the first and second ones) - the industry;

one digit (the third one) - the industry branch specialization;

three digits (the fourth, fifth and sixth ones) - concrete definition of tooling and equipment;

two digits (the seventh and eigth ones) - version of tooling and equipment within a class, for instance, 47 3798 0300 - assembly tooling for wood

tapping, 47 3798 0800 - cooperage tooling, 47 3798 1200 - hand tools for extraction of resinous wood;

one digit (the ninth one) - tooling and equipment type within the version, for instance, 47 3798 1210 - hand drills, 47 3798 1220 - digging shovels, 47 3798 1230 - detonating caps markers;

one digit (the tenth one) - concrete definition of products within the type.

A fragment of A-OKP is presented below:

Code	KCh	Description	Brand	Identification Parameters
47 398 0400	04	Ancillary tooling for wood tapping		
47 3798 0410	02	Resin blazes markers	1	TU 13-181-09-79
47 3798 0411	01	Wooden resin blazes marker	1RD	Same
47 3798 0412	00	Aluminum resin blazes marker	1RA	Same

The development of A-OKP for tooling and equipment for tapping and for production of wood tar and turpentine will make it possible to solve, using computers, problems of selling gross and marketable output, drawing up material balances, material resources accounting.

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ENSURING TECHNICAL UNIFORMITY OF PRODUCTION BY ASSIGNING OKP CLASSIFICATIONS OF PRODUCTS TO MINISTRIES AND AGENCIES

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 13-14

[Article by T.N. Vengerzhitskaya and T.G. Mironova (GNITsVOK) under the "DEVELOPMENT AND IMPLEMENTATION OF CLASSIFIERS AND USD" [Universal System of Documentation] rubric]

[Text] The central spot in the Unified System of Classification and Coding of Technical and Economic Information is taken by the Unionwide Classifier of Industrial and Agricultural Products (OKP), intended for ensuring uniformity of designation of products, manufactured in our country. Products, that are included in interagency documents and are for sale, are subject to classification and coding.

A product manufacturing start-up is performed, when there is an OKP code available, that is assigned at the stage of coordinating technical standards documentation with the base standardization organization before signing the certificate of the product manufacturing start-up.

In order to speed up the process of coordinating technical standards documentation and assigning an OKP code to a particular product, Gosstandart provides information reference service, as far as assigning OKP products classification to leading ministries and agencies is concerned.

Nowadays, a large number of head OKP organizations and leading OKP organizations of ministries and agencies, which are, as a rule, base standardization organizations, are involved in problems of products classification and coding.

Over 30% of head OKP organizations are not head OK TEI [Unionwide Classifier of Technical and Economic Information] organizations in their respective industries. In RSFSR, several head OKP organizations have been appointed.

In the process of maintaining and improving the OKP, its file is subject to changes, caused by emergemce of new classification objects, cancellation of obsolete items, change in classifications names, assigning reserve capacities and transferring existing K-OKP classifications from one ministry to another.

In accordance with the established order, when there is a need for reserve K-OKP classifications or series of A-OKP codes in classes or classifications,

assigned to other ministries and agencies, the head OKP or OK TEI organization, after having coordinated the problem with them, applies to Gosstandart, which assigns reserve classifications or transfers existing K-OKP classifications or series of A-OKP codes, registers them and reports the codes and titles of assigned and transferred classifications. After having received classifications, the ministry appoints head organizations for these classifications.

Information on assignment of reserve classifications is only published after K-OKP classifications have been approved in accordance with the established order and assigned to head OKP organizations.

Information materials, that Gosstandart distributes to head OK TEI and USD organizations and head OKP organizations and agencies, reflect the changes of:

head OKP organizations;

attributes of head OKP organizations;

titles of classifications, assigned to ministries or agencies;

leading OKP organizations or redistribution of products between head OKP organizations of the entire industry.

Up till now, Gosstandart information materials do not include head OKP organizations, that have not yet been assigned capacities in K-OKP, even though, as head standardization organizations, they have been assigned respective product groups. Also the information materials do not reflect data on head and leading OKP organizations, that have not yet submitted lists of K-OKP changes in assigned or reserve classifications.

In order to ensure technical uniformity of production, improve the quality of products, control their technical level and optimize types of products, it is necessary to accomplish complete asignment of products, manufactured in our country, to ministries and agencies.

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STANDARDIZATION OF DOCUMENTATION ON MAN-POWER RESOURCES

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 14-18

[Article by Candidate of Technical Sciences E.R. Iseyeva, G.B. Tsybysheva and T.N. Gezalova (GNITsVOK) under the "DEVELOPMENT AND IMPLEMENTATION OF CLASSIFIERS AND USD" [Universal System of Documentation] rubric]

[Text] Creation of ASU in USSR Goskomtrud has called for improvement of documents, that are in force in the sphere of manpower resources management, and because of this, the Unified System of Documentation on Labor and Social Problems (as far as manpower resources are concerned) has been created.

The objective of the development and implementation of the system was the development of documents, that as fully as possible meet the requirements of computer compilation and processing within automated management systems and contain information, required for the development and implementation of measures, directed at rational utilization of manpower resources; at improving the system of organized providing of manpower for the national economy and ensuring population employment; at performing state control of manpower utilization, of the conformance of the number of industrial, office and professional workers to labor schedules, of implementing measures on reducing rurn-over, meeting the quota on manpower distribution between Union republics, and of providing manpower for enterprises, that are being put into operation, with minimum expenditures for information acquisition, processing and communication.

The main objectives of manpower documentation standardization are:

improving the efficiency of management labor;

providing informational interaction and coordination of problems, solved by automated management systems at all levels of manpower management;

reducing the number of forms and indices and ensuring theyr stability;

regulation of information flows;

reducing labor content of documentation, calculation and analytic jobs, performed for making management decisions;

improving the quality of documents.

The documentation system includes the following:

State standards, that specify general requirements to the contents and form of unified documents (GOST 6.23.1-84 for basic data and GOST 6.23.2-84 for the system's sample form);

unified forms of documents with instructions on filling them out, used at all levels of management;

standard and methodological materials , developed in accordance with State standards.

State standards of the discussed system establish the purpose, the composition of manpower documentation, the requirements to the form of documents, documents' formats and margin sizes, principal attributes and rules for placement thereof, requirements to document blanks.

The unified documentation on manpower includes the following documents forms:

a report card for a person, that has applied for employment;

cumulative list of workers, sent to enterprises and organizations;

report on population employment in ... month, 19.. year;

report on population employment in ... quarter, 19.. year;

notification of availability of jobs and open positions as of 19.. year;

notification of assignment to a job;

registration card for a placed enterprise;

report on work on preparing findings, regarding placement of new and expansion and reconstruction of existing enterprises, for 19.. year;

registration card of an enterprise to be expanded, reconstructed;

typical labor contract for employment at an enterprise (organization) under organized hiring procedure;

application;

register of issuance of relocation tickets to heads of households of .... rayon;

ID;

register of one-time payment of money grant to migrants;

certificate of migrants' arrival to the relocation site;

report on meeting the plan quota for agricultural relocation in ... republic in ... quarter ... year (by Autonomous SSR, krays, oblasts of relocation);

same (by Autonomous SSR, krays, oblasts of exodus).

The composition of documents is determined by problems, that Goskomtrud and its agencies are solving at the time. It can change, as well as requirements to the form of documents, with the improvement of management functions and the contents of problems, that labor agencies are solving, using automated systems for manpower and population employment management. Further development of the Unified System can progress in the form of development of new standards and forms of documents on manpower resources and technical standards documents, as well as in the form of changes in acting standards, documents forms and technical standards documents.

The use of unified documents forms, developed in accordance with GOST 6.23.1-84 and GOST 6.23.2-84, is mandatory in All-Union, Union-Republic and Republic ministries, state committees, agencies and in their respective subordinate enterprises, construction sites, institutions and organizations.

General requirements to unified manpower resourses documents forms and procedures for filling out and processing thereof are established in accordance with GOST 6.10.1-80.

The Unified System of Documentation on Labor and Social Problems (as far as manpower resources are concerned) must ensure rational organization of work on transferring the information from documents onto machine media and inputting this information into a computer. Each document form, approved and registered in Gosstandart, must be assigned a code in the Unionwide Classifier of Control Documentation (OKUD).

Attributes, that have to be processed by computers, depending on their type and purpose, are coded in accordance with unionwide classifiers of technical and economic information. Documents' attributes are located within the boundaries, established by GOST 6.23.2-84.

The documents consist of three principal sections - title, contents and form.

The form section of documents, information from which is transfered onto machine media, contains additional attributes, that confirm the conformance of the contents of data, transferred onto machine media, to data in source documents.

Machinegrams, created as a result of computerized data processing, must meet the requirements of GOST 6.10.4-84.

The experimental implementation of unified documents forms in Moldavian SSR labor agencies demonstrated, that documents forms on manpower resources and instructions on filling them out do meet the requirements of documentation processing, both by traditional methods and in the automated management

system. The forms contain necessary information for the development and implementation of measures on organizing population employment; for control of providing manpower resources for new and reconstructed enterprises; meeting quotas of agricultural relocation plans; improving organized providing of manpower for national economy.

The implementation of unified documentation on manpower resources will make it possible to expand the sphere of automation of information processing and communication in the case of computer application and to reduce man-hours, required for processing of the documents.

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ON SYSTEM OF KEEPING 3185 OKP CLASSIFICATION 'SPECIALIZED EQUIPMENT AND DEVICES FOR RAILROAD TRANSPORT'

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 18-20

[Article by Z.G. Kozina, E.M. Sharifova (GNITsVOK), A.A. Nazarov and A.P. Orlyuk (PKTB ASUZhT) under the "KEEPING CLASSIFIERS AND USD" [Universal System of Documentation] rubric]

[Text] Updating nomenclature of products, developed and manufactured by enterprises and organizations of Ministry of Railways calls for rapid entering of changes and for relating information on these changes to users. A system of keeping the industry section of the OKP has been developed; its order of functioning is regulated by leading documents, that are based on leading typical documents of Gosstandart.

The industry regulations on keeping and improving OKP and OKP SEV [Council for Mutual Economic Assistance] defines principal functions of and interaction between organizations, as far as the keeping is concerned. The head organization, that performs scientific and methodological management of work on keeping the section, and leading organizations on assigned clasifications in accordance with objects of standardization or with product manufacturing specializatio have been appointed.

Therefore, the following order of processing of technical standards documentation has been established.

The enterprise-developer of specifications submits them for approval to base organizations on standardization; these organizations examine the specifications in order to check their conformance to State standards and other normative Gosstandart documents, determine product's classification and code, process the application in accordance with standard forms and send it for approval to the head organization for keeping the OKP.

The head organization, being the custodian of the standard of the industry section of the OKP, examines the application for correctness of classification and code selection, approves it and returns it to the leading organization.

The code for products, comprising subclassification 31 8550 "Specialized Equipment for Repair Installation, Repair and Maintenance of Rolling Stock and Rilroad Equipment", is determined in centralized order by the head organization for the OKP. This is because this subclassification includes

products, for which technical standards documentation is developed by enterprises of several main administrations.

The base organization on standardization determines a classification group at the six digits level and sends an inquiry to the head organization, that assigns the other four code digits.

According to the established order, the main functions of a head organization are: keeping the standard in an authentic condition, issuing collections of changes, organizing interaction with head organizations of other ministries and agencies on non-profile products, preparing and designing the issue of the industry section and providing OKP classes to ministry's organizations.

Keeping the A-OKP standard in a loose-leaf binder is performed by changing and adding new insert sheets to the classifier.

Simultaneously with keeping the standard, a standard is also kept on cards. After receiving an application, the industry fund official creates a card and includes it in or deletes it from the file. Thus, two files are organized, the standard file and the file of changes, which makes it possible to compile collections of changes without large expenditures.

For the convenience of using the classifier, an alphabetical-subject index has been developed. This index is kept simultaneously with the classifier standard.

At the same time, works are conducted on entering changes into a file, stored on machine media. Entering changes into this file is acomplished, using standard means.

Such organization of keeping the OKP made it possible to considerably reduce labor content of keeping the industry section and to get the standard ready in a short time for reissuance on a machine medium.

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EXPERIENCE OF KEEPING UNIONWIDE CLASSIFIER OF CONTROL DOCUMENTATION AS CLASSIFIER OF UNIFIED DOCUMENTS FORMS

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 86, pp 20-23

[Article by N.L. Ivanova, G.A. Prudnikova, S.V. Nagibina and Candidate of Historical Sciences Ye.L. Sonyechkina (GNITsVOK) under the "KEEPING CLASSIFIERS AND USD" [Universal System of Documentation] rubric]

[Text] The Unionwide Classifier of Control Documentation (OKUD) is a unified over the country systemized list of interindustry (interagency) unified forms of documents, that are part of unified systems of documentation (USD), and one of means of coordinating the OK TEI [Unionwide Classifier of Technical and Economic Information] with USD for unionwide application.

Documents forms in the OKUD are assigned seven-digit codes, that contain the classification (four digits) and identification (three digits) parts. For instance:

14 01009 Notice of Transferring the Application to a Foreign Patent Office, type 3.

The first two digits of the code (14) show, that the form belongs to the Unified System of Documentation on Inventions and Discoveries (class), the next two digits (01) show its relationship to documentation on control of patents operation in the USSR (subclass), and the last three digits show the consecutive registration number within the subclass. The seven-digit code of the form plays the role of its identifier in the OKUD forms file.

Thus, USD documents forms are unambiguously designated (identified) in the OKUD. The classifier is used for their registration and classyfication, for controlling the contents of forms in the USD and for forms retrieval.

The OKUD codes are shown in the forms typographically, in specially allocated zones.

In the process of developing new USD, including new forms in existing USD, refining titles and cancelling obsolete forms, appropriate changes are made in USD and OKUD in the process of keeping thereof. The order of keeping documents forms and the Classifier are coordinated with each other and with the order of forms registration.

The development, coordination and approval of newly created forms are performed by ministries (agencies), responsible for the USD development. These ministries (agencies) also take care of assigning OKUD codes to forms. The head organization of the ministry (agency) - developer presents proposals on forms coding. The proposed code is a part of basic data on the approved form, along with the form's title, the set of titles of attributes, their codes etc.

This conforms to the established rules for keeping the OKUD, because ministries (agencies), responsible for the development of particular USD, are at the same time a part of the OKUD keeping system as the developers of OKUD's respective classes.

Approved unified forms of documents for unionwide use undergo State registration at GNITsVOK, under Gosstandart.

The entry of a form into the State Register is preceded by a scientific and technical examination, at which stage the following is checked:

the conformance of the code to the classifier structure;

absence of duplication of codes;

the correctness of using the Classifier's reserve;

adherence to the sequence of asigning reserve codes.

In the case of a positive decision, the form code, proposed by the developers, becomes the form's registration number; the form is entered into the State Register under this number, and this constitutes the reason for including the form in the OKUD.

The same sequence of procedures is followed in changing titles and canceling forms: first, changes in the composition and the contents of forms are made by ministries (agencies), responsible for the USD development; they are then reflected in the State Forms Register, and after that they are entered into the OKUD.

At the time of approval the OKUD included 12 classes (about 3,500 forms), which corresponded to the number of USD, developed by that time.

Now 14 classes are identified in its structure:

Unified System of Planning Documentation (01-USPD);

Unified System for the Organization and Disposition of Documents (02-USORD);

Unified System of Basic Accounting Documentation (03-USPUD);

Unified System of Payment and Monetary Documentation (04-USRDD);

Unified System of Financial, Basic and Accounting Documentation for Budget

Institutions and Organizations (05-USFBD);

Unified System of Reporting and Statistical Documentation (06-USOSD);

Unified System of Documentation on Procurement and Selling of Materials and Equipment (08-USDMTS);

Unified System of Trade Documentation (09-USDT);

Unifed System of Foreign Trade Documentation (10-USDVT);

Unified System of Design Documentation for Capital Construction (11-USPDKS);

Unified System of Design Documentation (12-YeSKD);

Unified System of Technological Documentation (13-YeSTD);

Unified System of Documentation on Inventions and Discoveries (14-USDIO);

Unified System of Social Security Documentation (15-USDSO).

Class 01 is only represented in the OKUD by its title, because USSR Gosplan keeps forms of documents of the Unified System of Planning Documentation; class 07, which is kept by USSR Goskomtsen, is not included in the OKUD.

Classes 14 and 15 (22 and 27 documents forms, respectively) were added later.

The dynamics of changes in the OKUD in 1979-1985 is witnessed by the following data form collections of changes No 1-16. The total number of changes is 2,500 in 11 classes, including over 560 changes (classes 02, 03, 05, 06, 08, 10, 14, 15) in accordance with the "Include" instruction, over 150 changes (classes 03, 04, 05, 06, 08, 09) in accordance with the "Cancel" instruction, about 1,800 changes (classes 02, 03, 04, 05, 06, 08) in accordance with the "Change" instruction.

Thus, changes in accordance with all three instructions ("Include", "Cancel" and "Change") were made in four classes (03, 05, 06, 08).

The most dynamic is class 06 (USOSD), that includes over 3,000 unified documents forms. There have been made about 2,200 changes in it, mostly in accordance with the "Change" instruction.

The tremendously dynamic character of the composition of objects and the need to more rapidly notify subscribers about changes in the OKUD and USD made it necessary to issue the OKUD in loose-leaf binders (1984). Various industries have been provided with this classifier in accordance with their demand applications.

The OKUD makes it possible not only to settle the composition of unified documents forms, but also to optimize it, because, in the process of classifying forms, determining if they belong to a USD and comparing titles, directions for development of new forms are identified, as well as cases of

duplication and possible ways to eliminate them.

Therefore the OKUD role is now growing, because goals have been formulated to complete the development of unified systems and forms of documentation, used in the national economy, and at the same time to ensure further simplification and reduction of the number of existing forms and also the possibility of machine processing thereof.

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CLASSIFICATION SYSTEMS AND DOCUMENTS

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 5, May 86 pp 1-32

[Chapters 1, 2, and 3 and table of contents from journal edited by Yu. N. Litvinov, "Classification Systems and Documents," Vsesoynzny nauchno-issledovatelskiy institut tekhnicheskoy informatsii, klassifikatsii i kodirovaniya, Moscow, 1986, 2,500 copies, 32 pages]

[Text] CHAPTER 1. DATA BASE ORGANIZATION AND MANAGEMENT OF MANAGEMENT INFORMATION SYSTEM [MIS]. GENERAL PROBLEMS OF CLASSIFICATION, CODING, AND DATA MANAGEMENT SYSTEMS [DMS]

UDC 65.011.56.001.57:681.3

SYSTEMS CONCEPTUAL APPROACH TO SELECTING METHODS OF MODELING MANAGEMENT PROCESSES IN LARGE SYSTEMS (ON ORDER OF DISCUSSION)

[Article by Doctor of Technical Sciences V.A. Gerasimenko from the Moscow State Historical Archive Institute and Candidate of Physical and Mathematical Sciences V.I. Tairyan from the Armenian Department of the All-Union Scientific Research Institute on Problems of Management Organization]

Intensive searches are presently underway for more effective ways of using computer technology in management systems. An approach based on the idea of developing and introducing a so-called industrial technology for management automation, which includes a unified set of means (data items), methods, and measures permitting the implementation of management technology in a system of organizational and economic management, has been formulated in work [1] as a possible method of solving the given problem. Implementation of an industrial management automation technology assumes the standardization of using computer techology in management systems. Standardization of design methods and the optimal use of models of management processes is one of its most important aspects.

To date, a number of different modeling methods has been developed, and there has been considerable experience in using them to solve important research and specific applied problems. However, each method has been developed primarily proceeding from the requirements of solving specific applied problems. Insufficient attention has been paid to the problems of systems analysis of modeling

problems or to the possibilities and expediency of using different methods for modeling individual situations. Work [2] contains the principles of the so-called systems conceptual approach to analyzing and using modeling methods. The initial premises are as follows:

analysis from a unified position of as complete a set of modeling problems and methods as possible;

development of a unified noncontradictory concept for optimizing the use of methods when solving modeling problems.

The first part of the problem has been solved in work [2], i.e., a systems analysis of modeling problems and methods has been conducted. In its most general form, the essence of the solutions obtained may be presented in the following manner.

The following factors exert an effect on the selection of procedures and methods for modeling management processes in large systems:

degree of informativeness concerning the structure of the system being managed, the goals, and the order of its functioning, as well as about the effect of the external environment;

level of presentation of information (degree of its definiteness);

size of the problems, i.e., number of variables being sought and constraints applied to them;

number of criteria according to which the solution must be opitimized.

The first three factors determine the degree of the structure of the problem, and the latter determines the simplicity of the optimization process. We will take the following values for estimating the aforementioned factors:

degree of informativeness: complete, incomplete, fragmentary;

level of presenting information: quantitative, qualitative-quantitative, qualitative;

size of the problem: small, medium, large;

number of optimization criteria: one, several, many.

Then modeling problems may be classified in the following manner based on their degree of structure:

class of well-structured (well-formalized) problems, i.e., those problems whose structure is specified completely and unambiguously. This circumstance creates the prerequisites for a formal search for a strictly optimal solution;

class of weakly structured problems, i.e., problems whose structure is incompletely determined. Therefore, the necessary conditions for designing a

strictly formal procedure for searching for an optimal solution will be absent in the general case; however, the existing elements of structure may be used to construct a procedure providing the retrieval of a solution, which if not strictly optimal is close to it;

class of unstructured problems, i.e., problems that are unstructured in the most significant parts. Therefore, in the general case, it is only possible to guarantee the search for a certain rational solution and only on the basis of specified heuristic procedures.

Classification of modeling methods is done according to two features: degree of formalization and method of implementation.

With respect to degree of formalization, modeling methods are divided into finite, formal-heuristic, and informal-heuristic.

The finite methods include those that make it possible to find an optimal (or statistically close to it) solution in a finite number of steps of strictly formal computing procedure. The classical optimization, mathematical programming, game theory, random search theory, and simulation methods are some of them.

The formalization of heuristic procedures used by a person in the process of solving weakly structured problems lies at the basis of the formal-heuristic method. Methods of the theory of fuzzy sets and "artificial intelligence" are among them.

Methods based on the search by a person (or collective of people) for an optimal solution when managing this process are called informal-heuristic. The expert evaluation, "brainstorm," and psychointellectual generation methods are among them.

With respect to implementation, modeling methods are divided into analytical, statistical, and man-machine methods.

The analytical methods include those that make it possible to construct a model in the form of a certain set of analytical formulas; the values of the unknown magnitudes may be determined by a sequence of analytical computations.

The methods that are called statistical are those that make it possible to construct a model simulating a random process of obtaining unknown data. Obtaining unknown data consists of the multiple implementation of the aforementioned process and the statistical processing of the results of modeling.

The man-machine methods include those whose implementation requires the participation of a person who generates the information necessary for determining the unknown values and who makes decisions.

The area of applying the methods of solving the problem of modeling management processes in large systems may be represented in the following manner.

Classic optimization methods may be used to determine optimal development times of new types of devices; selecting the optimal type of hardware; determining

optimal reliability, the optimal mode of simulators, optimal prevention regimens, and redundancy of hardware.

Mathematical programming methods may be used to minimize the volumes of service information being sent, the configuration of management means, and the structure of applications packages and to select optimal routes of sending information.

Theoretical and game methods may be used to discover and localize trouble zones in a system and to optimize the distribution of resources and means.

Random search methods are intended to correct system function plans and use management means and resources.

Simulation modeling methods may be used to analyze the quality of the function of systems and changes anticipated under conditions of their functioning and when estimating the volume of computations for solving management problems.

Fuzzy set theory methods may be used when determining the order of using the resources of a system and system management means, distributing management resources and means, evaluating the quality of the functioning of a system, and developing proposals for improving the structure and technology of the functioning of systems.

"Artificial intelligence" methods and informal-heuristic methods are intended for analyzing the goals of the functioning of systems, establishing requirements for developing the structure and technology of the functioning of systems, and developing a program for creating and producing management means.

The principal approaches for solving the second part of the problem, i.e., for developing concepts for using methods for solving modeling, may be formulated in the following manner.

The effectiveness of solving problems of modeling management processes in large systems by a certain method is determined by a number of factors:

adequacy of the model constructed on the basis of the given method for the management process being modeled;

labor-intensiveness of the algorithm implementing the model;

mean average of the algorithm implementing the model;

tolerance of the decision, i.e., convenience of making and using the decision.

Consequently, the effectiveness of solving a specified class of problems by a given modeling method may be characterized quantitatively by the vector index $E = (E_1, E_2, E_3, E_4)$, where E_1 is the method's adequacy index, E_2 is the method's labor-intensiveness index, E_3 is the method's error index, and E_4 is the method's tolerance index.

Thus, in the case of unlimited resources, the development of a system of methods that are optimal (particularly Pareto-optimal) with respect to the vector index $E = (E_1, E_2, E_3, E_4)$, which in their aggregate make it possible to solve all classes of modeling problems, is a necessary condition of the concept of the optimal use of modeling methods for modeling management processes in large systems.

Naturally, the following optimization problem must be solved when there are constraints on resources.

Let us designate the set of classes of problems of modeling management processes in large systems as $Z = \{Z_1, Z_2, \ldots, Z_n\}$. $M = \{m_1, m_2, \ldots, m_k\}$ is the set of modeling methods. Each method $m_i (i = \overline{1,k})$ is characterized by the vector index $E = (E_{1i}, E_{2i}, E_{3i}, E_{4i})$. The values R_{ij} $(i = \overline{1,k};\ j = \overline{1,n})$, which represent the resource necessary to solve the class of problems Z_j by the method m_i, and R, the maximally allowable value of resources for solving the set of classes of problems Z, are assigned.

It is necessary to find the minimal subset $N = \{m_{i_1}, m_{i_2}, \ldots, m_{i_t}\}$, $\{i_1, i_2, \ldots, i_t\}$ $\{1, 2, \ldots, k\}$ of the set M such that in aggregate the methods $m_{i1}, m_{i2}, \ldots, m_{it}$ make it possible to solve all problems from Z and such that the following takes place:

$$\sum_{i=i_1, i_2, \ldots i_t} \sum_{j=1}^{n} R_{ij} \leq R.$$

The approaches examined have been used in developing a concept of the complex management of the activity of computer systems and networks. The main assumptions of this concept have been discussed in work [3].

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SOFTWARE IMPLEMENTATION OF SEMANTIC FILTER FOR CERTAIN CLASS OF DATA BASE MANAGEMENT SYSTEMS

[Article by V.N. Shafranov from the Gorsistemotekhnika Scientific-Production Organization, Kiev]

The provision of an adequate display of the status of a subject area is a necessary condition in the functioning of a data bank. This task is relatively simple when the properties of one type of object are displayed in the data base. There is only one type of incoming message entering from a source registering a specified type of object. In this case, displaying the changes in the subject area is reduced to the simple addition to the data base of the information contained in the input messages. The expediency of introducing a data bank is conditioned by the presence of a subject area that includes a set of different types of objects with different connections between them, multiple sources registering the characteristics of uniform and diverse objects, and diverse input messages.

In such cases, the task of displaying the changes in a subject area in the data base is complicated significantly.

First, it is practically impossible to implement the principle of single registration of the properties of a subject area. In a real data bank many input messages will include information already existing in the data base (as the minimum in the volume necessary to identify a certain object or its properties). If redundant data are not excluded from these messages, this will be reflected by an increase in the physical volume of the data base and other parameters.

Second, complex interconnections may exist between the objects of the subject area, the attributes of the object, and the values of one or other properties of the object. The nature of these interconnections is very diverse and is determinied by the semantics of the subject area. When displaying new properties of a subject area in a data base, it is thus necessary that they not contradict the static and dynamic constraints inherent to the given subject area [1] or to the current status of the data base. Implementing the process of creating a data base without controlling the changes introduced may result in the data base ceasing to display the subject area corresponding to it.

Third, the specified changes in the subject area may interest the data bank users and even determine the main purpose of introducing the data bank. This in turn requires communicating the procedure for updating the data base with new information with a procedure for selectively informing data bank users.

The process of displaying changes in subject area in the data base assumes the presence in the data bank software of means for implementing a wider nomenclature of operations over the input messages and data base than the simple entry of information. At the same time, means of updating and creating a data base are insufficiently developed or generally absent in modern data bank software (including data base management systems [DBMS] and services). Usually, data base update programs only implement the physical transfer into the data base of all information contained in the input message being processed. Frequently,

the functioning of such programs is connected with certain constraints in their use. The necessity of interrupting connections between the data base files being updated, the subsequent processing of each of them, and the restoration of the connections of the files after completion of the processing procedures is an example of the constraints for a system-loading utility. This is caused by the semantic weakness of the languages for describing data of DBMS [2, 3]. In recent years, specialists' interest in problems of expanding the semantic capabilities of data banks has increased significantly.

It is assumed that in the future, DBMS will be configured with powerful languages for determining conceptual schemes that allow for the semantics of the subject area. A software apparatus that will make it possible to maintain the adequacy between the data base and subject area will receive corresponding development.

The effectiveness of operating data banks implemented using modern DBMS will be improved, possibly with the help of methods and means expanding the semantic capabilities of languages describing data and providing the function of checking the semantic appropriateness of the data base. Similar means are called semantic filters and information processors, etc., in the literature.

The present work describes one possible approach to software implementation of a semantic filter. The proposed approach was tested during the creation and introduction of the AVRORA applications package [4]. It may be used without fundamental changes for an analogous class of DBMS (SPEKTR, DISOD). The methodology of expanding the semantic expressiveness of data description languages has been discussed in works [1 and 5], and problems of their practical use have been discussed in work [6]. General information about the designation and functioning principle of the LOADAVS utility, which fulfills the role of a semantic filter in a data bank implemented using the AVRORA applications package, will be presented in the following section.

The LOADAVS utility is intended to display the current status of the subject area in the data base adequately. The display process must be implemented in strict accordance with a detailed description of the semantics of this area, the specified conceptual scheme of the data base, and the implementation of the process must guarantee the semantic appropriateness of the data base and a high degree of technological feasibility.

Proceeding from the designation of the LOADAVS utility, the following functions are placed in it:

identification of the type of input message incoming for processing and selection of an algorithm to analyze it with an allowance for the current status of the data base;

implementation of an algorithm to analyze and check which changes in the subject area that are contained in the input message are new for the data base and are subject to being displayed in it, whether these changes are of interest to the data bank users, and whether there are any cases of violating the static and dynamic constraints of the subject area and the established technology of the functioning of the data bank;

management of the process of updating the data base and implementing operations of writing new data into it and correcting its existing data;

formation and documentation of messages for data bank users and individuals responsible for its operation concerning the subject area and violations in the functioning technology;

formation and documentation of a report on the results of the utility's operation.

The LOADAVS utility consists of two modules: LOAD and UNITAB. The LOAD module is the main management procedure with respect to the UNITAB module and implements all the main functions of the utility with the exception of forming and printing messages. This function is implemented by the UNITAB module, which may operate offline or be called up by the LOAD module when it is necessary to print out a message. In the first case, the data necessary for forming the message are prepared by the LOAD module on magnetic tape (disk), which is used by the UNITAB module. The required operating mode is specified by the operator.

A file of input messages, which are prepared by information input and testing means (the WWOD module), are the source data for the utility. The set of data contained in the input document is called the input message. All input messages of one type bear an identical semantic load, and identical operations related to inputting, checking, and loading them into the data base may be used for them.

The concept of an "input message" is narrower than the concept of an "input document." One and the same type of input document may be used to register one or several types of input messages. The AVRORA applications package provides for more than 500 types of input messages, each of which must have an identical identifier assimilated for it. The WWOD and LOAD modules recognize the type of message and automatically adjust for work with it on the basis of the meaning of this identifier. This makes it possible to allow a random order of types of messages for the data bank in the input file. The structure of the input messages contained in the input file is another one of its features. The WWOD module reduces them to a form corresponding to the description of data in the data base (distribution of data according to files, order of their sequence in the file, form of representation, etc.). Any type of input message may contain data correlatable with 15 different data base files.

The LOAD module used the services of the AVRORA DBMS in its operating process. All operations with the data base (retrieval, reading, adding, updating) are accomplished with the help of an instruction from a data manipulation language.

Adjustment of the LOAD module for operation under specific conditions is accomplished with the help of FILES tables (contain a description of data base files in the data description language), FORVS tables (contain a description of the format and retrieval buffers and the buffers of values for retrieval in the usable files of the data base), KRIT software units (contain a description of the values of criteria for analyzing input messages and data bases), and SITU software units (contain a description of the structure of OUT file records and load variations).

The FILES tables and KRIT and SITU software units represent a description of the conceptual scheme of the data base and consist of two sections:

a description of the static properties of the essences of the subject area and the main interconnections permissable among them, which is implemented in the terms and constructions of the data description language;

specification of the dynamic aspects of the subject area and allowable conditions that may not be expressed with the help of the data description language of the DBMS being used.

Having a description of the conceptual scheme at its disposal, the LOADAVS utility checks the implementation of the necessary conditions based on an algorithm corresponding to the type of input message being processed.

The time required to process one input message depends on its type, the number of files being processed, and the size and form of transaction tables.

In the general case, the output information of the LOAD module is:

a data base updated with new data from processed input messages;

a data file that is necessary for forming user messages (OUT file).

The file is formed on magnetic tape (magnetic disk) and consists of variable-length records, each of which is intended for subsequent documentation of a specific user message. In the particular case where situations related to forming user messages do not arise in the processing process, the OUT file is empty.

The UNITAB module implements the formation and documentation of the user messages.

The input information for this module is the OUT file, which is prepared by the LOAD module. Adjustment of the module for operation under specific conditions is accomplished with the help of the following tables: TABS (they determine the correspondence between the values of the situation code and the forms of the user messages), FORMA (they determine the form of the user message and the algorithm for implementing it), and STEPLP (they determine the classification system of the values of the data base fields that participate in forming the user message).

The form of the user message is determined by the data base administrator, and the content is determined by the specific data. The number of types of these messages must not exceed 999.

The LOADAVS utility provides a high degree of automation of the production process directed toward updating the data base, does not require preliminary preparation of the package of input messages and the data base, and makes it possible to eliminate such traditionally manual and rather complex operations as analyzing input messages and preparing and sending data bank user messages from the functions of the operator. In fact the LOADAVS utility simulates the activity of service personnel with respect to analyzing incoming input messages and making decisions in any of the theoretically possible situations that may arise in the process of the functioning of the data bank. In addition, the

utility combines the functions of loading and correcting the data base as well as the functions of a generator of a certain class of output documents. Also important is the fact that all functions are managed automatically based on the results obtained in the course of analyzing the input messages.

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FUNCTIONS AND STRUCTURE OF METADATA IN AUTOMATED CONTROL SYSTEM FOR PLANNING CALCULATIONS OF UkSSR GOSPLAN

[Article by Ye.G. Pazyuk and S.N. Sheleshkova of the Main Scientific Research Institute Computer Center of the UkSSR Gosplan]

Data making it possible for an automated data bank administration service to use specific management decisions are necessary for effective management of the information store of the data bank of different levels of MIS (ASU).

Managing an information store involves providing for its integration, reducing the redundancy of information by checking for duplication, protecting information against unsanctioned access, and also making a complex of management decisions that are necessary for the functioning of the data bank administration service.

Making management decisions requires metadata files that provide the functioning of the specified service. Metadata means information about the organization of information, its structure, content, and users. The metadata files in the UkSSR Gosplan Automated Control System for Planning Calculations [ASPR] have been formed by creating a system of charts for the information objects of the MIS.

When designing such a system, it is necessary to observe the following principles: the charts must have a tabular structure, all the information must be described using a unified data language, the data contained in the charts must reflect the subject area comprehensively, and the intersecting flags must have an identical numeration.

The charts of the information objects are constructed in the form of a table and have a matrix form where the constant flags of the object are latched in the subject. It is possible to increase the number of flags without changing the order of their sequence in the table when it is necessary to expand the matrix.

In an MIS for an information object, there are tasks, document forms, the information store as a whole, and its components, store segma, sectors, and also batches of messages of the user subsystem.

A specially developed departmental classification system [VKTESP], which is based on the All-Union Classification System of Technical-Economic and Social Indices [OKTESP], was used to describe the flags of the charts of the information objects in the UkSSR Gosplan ASPR.

The structure of the VKTESP is analogous to that of the central section of the OKTESP; however, it has its distinctive features, which are related to the explicit separation of components participating in intersystem exchange and components reflecting the specifics of the specific subject area.

Unified documentation systems, descriptions of input (output) tasks, formalized systems of data streams and files, etc., were the source of the formation of the VKTESP.

The VKTESP contains a header record, list of types of indices and lists of index flags, lists of flag meanings, lists of flag sets and position-templates, and recoding tables for the central section of the OKTESP according to components used in the intersystem exchange.

The system of information object charts has been constructed with an allowance for the requirements of adequate reflection of the subject area. The charts are linked based on flags, in accordance with which the connection of information objects is developed. In general, the system of charts and their connections have been the basis for creating a model of a subject area that may be implemented using the VKTESP.

The information object chart is divided into bases containing the main characteristics of the information store (document chart, task chart, and chart for an elemental part of the information store) and consolidated derivatives containing a derivative and processed information (information stream chart, chart

for the information store and a sector of a specific DBMS maintained, chart for the information store as a whole, and chart for the user subsystem).

The base charts have initial values of the properties that may be included in the derivative charts in an unchanged or aggregate form as well as in the form of a list.

The creation of a metadata base was accomplished in several stages: developing charts of the information objects and instructive materials on their formation, filling the charts, coding the chart data using the VKTESP, preparing charts for input into the computer, loading into the computer, and forming the metadata bases.

The chart system for the information objects includes 70 flags that reflect the methodological aspects of the design and function of the information objects; semantic, structural, volume, software, and hardware characteristics of the objects; time parameter for information entry and formation during the design and functioning of the ASPR, and characteristics of the interconnections of the information objects.

With respect to their functional designation, the metadata may be divided into semantic information, physical characteristics, and information about their use.

Semantic information describes the semantic value of the entire information base and the individual data bases.

Metadata make it possible to correlate objects of a subject area and the functions fulfilled by them with elements and structures serving to display them in the data base. The semantic meaning of information is expressed with the help of the VKTESP.

The following form of metadata comprises the physical characteristics of data bases such as description of keys, data type, and interconnection of information in the data base. Information about using the data includes a list of tasks, processing functions presented to the user, and password data protection.

Existing software was used when forming the data base.

Processing a metadata base requires the development of a special information and reference system that makes it possible to analyze metadata for making management decisions. Information must be output to a terminal device for operation of the administration service of the automated data bank in an interactive mode or to an alphanumeric printer [ATsPU].

Analyzing the metadata base makes it possible to establish the composition, content, and structure of the information base; times for entry of information into the system and times for preparing information for accomplishing tasks; provide the information necessary to accomplish tasks; dispatch the accomplishment of tasks in the system; and determine the order of forming parts of the store and its components and the rationality of accomplishing tasks and complexes of tasks.

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RATIONAL SELECTION OF COMMUNICATION CHANNEL WHEN TRANSMITTING DATA

[Article by R.Sh. Sarkisov]

The semantic processing of data by humans when obtaining information subject to refinement based on classification systems for technical and economic information has a significant effect on the rate of data transmission. Refinement has been made necessary by a number of factors including the complexity of the structure of codes and descriptors of objects in the classification systems of enterprises, branch (departmental) and other categories; the great length of codes and descriptors; insufficient mnemonicity of codes; and, in a number of cases, ambiguity of the designation of objects.

The number of refinements is a direct function of the time expenditures required to comprehend the information.

Объем информации, требующей уточнения, % (1)	$T' = T''$ смысловая обработка переспроса, с (2)	$V_{ист}$, (3) бит/с (4)	$\lg V_{ист}$ (3)	V_0, бит/с (4)	$\lg V_0$
		Телеграфный канал (5)			
20	600	5,8	0,7634	50	I,7
I0	300	II	I,04I4	50	I,7
5	I50	I8	I,2553	50	I,7
2,5	75	25	I,3979	50	I,7
0,9	27	40	I,602I	50	I,7
0,5	I5	42	I,6232	50	I,7
		Телефонный канал (6)			
20	600	7	0,845I	I200	3,I
I0	300	I4,4	I,I584	I200	3,I
5	I50	30	I,477I	I200	3,I
2,5	75	60	I,7782	I200	3,I
0,9	27	I44	2,I584	I200	3,I
0,5	I5	240	2,3802	I200	3,I
		Широкополосный канал (7)			
20	600	7	0,845I	48000	4,6
I0	300	I4,4	I,I584	48000	4,6
5	I50	28,8	I,4594	48000	4,6
2,5	75	57,6	I,7604	48000	4,6
0,9	27	I44	2,I584	48000	4,6
0,5	I5	288	2,4594	48000	4,6

Table 1. Key:

1. Volume of information requiring refinement, %
2. $T' = T''$ semantic processing of the repeated request, s
3. V
4. Bits/s
5. Telegraph channel
6. Telephone channel
7. Wideband channel

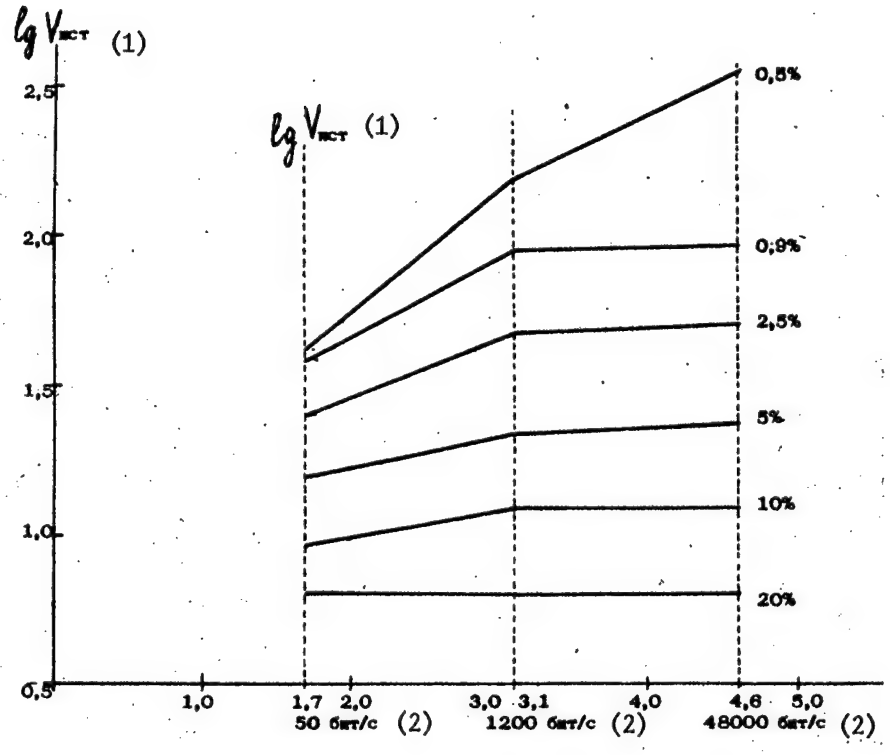

Figure 1.

Key:

1. V_{true}
2. Bits/s

The true data transmission rate during a repeated request, which bears the semantic character (V_{true}), is determined by the following expression:

$$V_{true} = V_0 \frac{t}{3T_1 + 3T_2 + t + \tau_1 + \tau_2 + T' + T''},$$

where V_0 - data transmission rate;
t - pure data transmission time;
T_1 and T_2 - time of readying and shutting down terminal equipment;
τ_1 and τ_2 - pure data transmission time during a repeated request;
T' and T'' - time of semantic (logical) processing of data by a human

A leveling of the data transmission rate along the different channel is observed when 20 percent or more of the information needs refinement. Estimating the effect on the data transmission rate along the different channels of information from classification systems in which less than 20 percent of the information needs refinement is of interest.

In accordance with the obtained rate correlation, the Figure presents the relations (in percentages) of the true transmission rate along the different communication channels to the amount of information in need of refinement. The relations have been constructed based on the source data obtained in the Table.

If the volume of information in need of refinement comprises from 0.5 to 20 percent, then the true data transmission rate in a repeated request mode is approximately identical in telephone and wideband communication channels.

The cost of the lease of a wideband communication channel is five times greater than the lease cost of a telephone channel [1]; therefore, it is expedient to use telephone communication channels in the specified operations mode (the repeated request mode).

For practical purposes, the minimal level of information in need of refinement (0.5 percent) taken into account may be considered acceptable for empirically existing classification systems for technical and economic information.

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CHAPTER 2. DEVELOPMENT AND INTRODUCTION OF CLASSIFICATION SYSTEMS AND DMS

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ONE METHOD OF SELECTING FORM PARAMETERS OF DOCUMENTS IN INTEGRATED DATA PROCESSING SYSTEMS (ON ORDER OF DISCUSSION)

[Article by Yu.M. Kuchukov of the NIIP (not further identified) of the LaSSR Gosplan]

New problems of unifying forms of documents appear under conditions of the functioning of an integrtated data processing system [IDPS]. Solving such problems assumes working out criteria for the form parameters of documents with an allowance for the effectiveness of their functioning in the system. In this context, examining the problem of optimizing the values of the form parameters of a document according to criteria for the effectiveness of the functioning of the data processing system as a whole and the functioning of its individual production components is important.

In the general case, under the condition where the values of the elements from the set E_i must belong to a certain specified domain of values D, the given problem may be formulated in the following manner [1]:

to optimize $$W = \sum_{i=1}^{n} (\tau_i \cdot W_i) = \sum_{i=1}^{n} (\tau_i \cdot F_i (E_i, L_i)),$$

where W, W_i - criteria for estimating the effectiveness of the functioning of the components of production process of the IDPS;
n - number of components of the producton process;
τ_i - weight factor of a criterion for the i-th element of the producton process of the IDPS;
E_i - set of the form parameters of a document;
L_i -assigned set of parameters of the data processing system (it is assumed that the values of the elements in the set L_i are known).

We will examine the frequent problem of optimization of the form of documents with specified properties on the example of the production process "Input of a Model Document Form into a Data Base in an Interactive Mode," which has been implemented according to the technology accepted at the LaSSR Gosplan Main Collective-Use Computer Center [GVTsKP].

Let there be a known set D of admissable variations of displaying the form of a document with specified properties. The size of the set D is bounded by the requirements of the standards for constructing the form of the document and the semantic structure of the information displayed. Then each element of the set D may be characterized by the specific values of the following document form parameters:

total number of characters specifying the form of the document (E_{3H});

number of lines in the document forms (E_C);

maximal line size of the document form (E_K).

Optimizing the form of a document with the specified properties and specified processing production process is a function of the admissable variations of the document form, i.e., in this case, the optimization problem may be reduced to the following:

$$\text{optimize } W_i = F(E_{3H}, E_C, E_K, L). \qquad (1)$$

For the production process of processing the form of the document and making an allowance for the indices of the effectiveness of the functioning of the components of the IDPS that are proposed in work [2], (1) is written in the following form:

$$\text{minimize} \qquad z = c \cdot t_э / \mu + a_c \cdot t_э + z_н + z_c \qquad (2)$$

$$\left.\begin{aligned}
& t_э = t_{нф} + t_п + t_{эф};\\
& t_{нф} = \sum_j^K (Q_{3нj}/V_н + Q_{3нj}/V_{um} + (E_{cj} \cdot E_{кj} - Q_{3нj})/V_к);\\
& K = БЦЧ(E_c/\tau_c) \cdot БЦЧ(E_к/\tau_к);\\
& t_п = [\sum_j^K ((n_j(\tau_к+3)+3) + Q_{сл})]/V_п;\\
& t_{эф} = m(t_д + t_{ожк});\\
& m = БЦЧ(E_c/\lambda);\\
& \lambda = round[(3000-\ell_п)/E_к - 0{,}4999];\\
& t_д = \frac{N(N+2)}{3(N+1)} \cdot \Delta t + 1/(2 \cdot v) + 2(v(S+1));\\
& \Delta t = (R_к - R_1)/(v \cdot N_{max}),
\end{aligned}\right\} \quad (3)$$

where Z - expenditures for inputting the specified document form into the data base in an interactive mode;

c - cost of a unit of computer use time;

t_3 - computer use time for input of a specified document form in an interactive mode;

m - multiprogramming factor of computer use;

a_C - wages of the computer center worker performing the specified form of processing the document form;

Z_H - invoice expenditures;

Z_C - deductions for social insurance

$t_{H\phi}$ - estimate of the time of setting the document form on the display screen;

$t_П$ - rough estimate of the time to send a document form from the display screen to the computer's buffer from a remote terminal along commumication channels;

$t_{3\phi}$ - rough estimate of the direct writing time of the specified document form into the data base;

Q_{3Hj} - quantity of characters of the given document form on the screen;

V_H - speed of setting the document form on the display screen;

$V_{чm}$ - speed of reading the document form by the computer center worker (specialist);

E_{cj} - line length of the document form on the screen;

E_{Kj} - amount of lines of the document form on the screen;

V_K - speed of cursor movement along the screen;

K - number of screens necessary to input the specified document form;

БЦЧ - function of the "closest whole number";

C'_K - number of lines and character positions in a line on the region of the screen intended for inputting the document form;

n_j - number of lines of the j-th screen necessary for setting the document form;

$Q_{СЛ}$ - number of service symbols when sending a message along communication channels;

V_n - rate of data transmission along communication channels;

m - number of references to the information disk unit on which the data base is located during direct writing of the specified document form;

$t_Д$ - rough estimate of the time of one reference to the disk unit on which the data base is located;

$t_{ож}$ - average waiting time for access to the disk unit on which the data base is located;

ln - size of the identified section of one file record of the document form models;

N - volume of data base;

v - angular velocity of the rotation of a packet of magnetic disks;

S + 1 - number of blocks of physical records located on one track of the data base's magnetic disk;

R_1, R_2 - radii of the internal and external magnetic disk tracks;

v - mean radial speed of the shifting of the magnetic disk head unit;

N_{max} - number of tracks on the magnetic disk.

The values of the document form parameters are determined by using the method of the exhaustive search for admissible variations of displaying the form of a document with specified properties. For example, let it be necessary to input a document form in an interactive model of working with a data base, a plan for the yearly estimated cost of developing an assigned theme of scientific research work [NIR] for a specified department of an institute in a cross section of each quarter and items of the expenditures.

The conditionally possible variations (A, B, C, D) and forms of the specied document are illustrated at the end of this article. Variations A and B are distinguished by their number of lines in the head (variations C and D are analogous). Different values of the expenditures index and the time components of inputting the four variations in document form for the condition where

Table 1.

Показатели ввода данных в систему (1)	Вариант A (2)	Вариант B	Вариант C	Вариант D
Общее число знаков формы документа, вводимых с экрана дисплея (3)	972	954	I059	I042
Число строк формы документа (4)	24	23	I7	I6
Ширина строк формы документа (5)	67	67	I07	I07
Время набора формы документа на экране (мин) (6)	20,5	20,I	22,4	22,0
Время передачи формы документа по каналам связи в ЭВМ с удаленного АП (с) (7)	6,64	6,37	9,37	8,83
Ориентировочное время записи формы документа в базу метаданных (MS) (8)	64,9	64,9	64,9	64,9
Количество обращений к базе метаданных при записи формы документа (9)	I	I	I	I
Стоимость использования ЭВМ для ввода заданной формы документа (руб.) (10)	I8,59	I8,22	20,34	I9,95
Затраты на ввод заданной формы документа в диалоговом режиме (руб.) (11)	I9,II	I8,72	20,90	20,50

Key:

1. Indices of data input into the system
2. Variation
3. Total number of characters of the document form input from the display screen
4. Number of lines of the document form
5. Line width of the document form
6. Time of setting the document form on the screen (min)
7. Time of sending the document form along communication channels into a computer from a remote user station [AP] (s)
8. Rough time of writing the document form into the metadata base (MS)
9. Number of references to the metadata base when writing the document form
10. Cost of using the computer to input the specified document form (rubles)
11. Expenditures to input the specified document form in an interactive mode (rubles)

Table 2.

Идентификатор параметра (1)	Единица измерения (2)	Численное значение (3)
$v_н$	зн/мин (4)	50,0
$v_{чт}$	зн/с (5)	28,0
$v_к$	зн/мин (4)	I200,0
$z_с$	строка (6)	22
$z_к$	байт (7)	79
$Q_{сл}$	байт (7)	9
$v_п$	бит/с (8)	2400,0
$l_п$	байт (7)	6I
N	цилиндр (9)	6
v	I/с (10)	40
$S+l$	запись (11)	2
$2*R_2$	мм	330,5
$2*R_1$	мм	226,8
N_{max}	дорожка МД (12)	208
Δt	MS	I2,0
c	руб/ч (13)	54,0
μ		I,0
$a_с$	руб/мес (14)	I50,0

Key:

1. Parameter identifier
2. Unit of measurement
3. Numerical value
4. Characters/min
5. Characters/s
6. Line
7. Bytes
8. Bits/s
9. Cylinder
10. I/s
11. Records
12. Magnetic disk track
13. Rubles/hr
14. Rubles/mo

Variation A.

ДАТА:DD.MM.GG (10) С М Е Т Н А Я С Т О И М О С Т Ь
(12) ТЕМА: < ШИФР > < НАИМЕНОВАНИЕ ОТДЕЛА (11) >
(13) ФИНАНСИРОВАНИЕ < ВИД ФИНАНСИРОВАНИЯ > РУБ.

	I КВАРТАЛ	2 КВАРТАЛ	3 КВАРТАЛ	4 КВАРТАЛ	ИТОГО ЗА ГОД
	(14)			(14)	(15)
1. ЗАРАБОТНАЯ ПЛАТА	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
2. ОТЧИСЛЕНИЯ СОЦСТРАХ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
3. НАКЛАДНЫЕ РАСХОДЫ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
4. КОМАНДИРОВКИ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
5. УСЛУГИ СТОРОН.ОРГ.	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
6. ОПЛАТА ЭВМ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
7. НЕШТАТНАЯ ЗАРПЛАТА	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
8. ПРОЧИЕ ЗАТРАТЫ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
9. И Т О Г О	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа

Variation B.

ДАТА:DD.MM.GG СМЕТНАЯ СТОИМОСТЬ (10)
ТЕМА: < ШИФР > < НАИМЕНОВАНИЕ ОТДЕЛА (11) >
(12) ФИНАНСИРОВАНИЕ < ВИД ФИНАНСИРОВАНИЯ > (13) РУБ.

	I КВАРТАЛ	2 КВАРТАЛ	3 КВАРТАЛ	4 КВАРТАЛ	ИТОГО ЗА ГОД
	(14)			(14)	(15)
1. ЗАРАБОТНАЯ ПЛАТА	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
2. ОТЧИСЛЕНИЯ СОЦСТРАХ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
3. НАКЛАДНЫЕ РАСХОДЫ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
4. КОМАНДИРОВКИ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
5. УСЛУГИ СТОРОН.ОРГ.	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
6. ОПЛАТА ЭВМ	ааааа	ааааа	ааааа	ааааа	ааааа
7. НЕШТАТНАЯ ЗАРПЛАТА	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
8. ПРОЧИЕ ЗАТРАТЫ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа
9. И Т О Г О	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа

Key: Variations A and B

1. Wages
2. Social insurance deductions
3. Invoice expenditures
4. Out-of-town jobs
5. Services of extraneous organs
6. Computer charge
7. Supernumerary wages
8. Miscellaneous expenditures
9. Total
10. Estimated cost
11. Department Name
12. Theme <code>
13. Financing <type of financing> rubles
14. Quarter
15. Total for year

$t_{отр}$ = 0 (Table 2) have been obtained based on expressions (2) and (3) and the values of the production parameters from Table 1. These expenditure estimates were obtainined with the help of an interactive system for modeling the parameters of the document forms that has been implemented in the software of the LaSSR Gosplan GVTsKP.

Analyzing the results obtained shows that the relative minimum expenditures of inputting the form of the specified document is attained in variation B.

An analogous selection of an optimal variation of a document form with specified properties may also be made for a set of individual production components of the process of processing documents and for IDPS in general with an allowance for the ranging of each component of the production process.

Inasmuch as determining the set of the relations $W_i = F_i(E_i, L_i)$ has analytical expressions, it is possible to reduce the labor-intensiveness of selecting the optimal variation of a document form thanks to automation of the estimation of the values of the effectiveness indices of the functions of the corresponding components of the IDPS production process.

Variation C.

ДАТА:DD.MM.GG СМЕТНАЯ СТОИМОСТЬ (1)
ТЕМА: < ШИФР >(3) < НАИМЕНОВАНИЕ ОТДЕЛА (2) >
ФИНАНСИРОВАНИЕ < ВИД ФИНАНСИРОВАНИЯ > (4) руб. (5)

	(6) ЗАРАБОТНАЯ ПЛАТА	ОТЧИСЛЕНИЯ НА СОЦСТРАХ (7)	НАКЛАДНЫЕ РАСХОДЫ (8)	КОМАНДИРОВКИ (9)	УСЛУГИ СТОРОН.ОРГ. (10)	ОПЛАТА ЭВМ (11)	НЕШТАТНАЯ ЗАРПЛАТА (12)	ПРОЧИЕ ЗАТРАТЫ (13)	ИТОГО (14)
1 КВАРТАЛ (15)	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
2 КВАРТАЛ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
3 КВАРТАЛ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
4 КВАРТАЛ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
ИТОГО ЗА ГОД (16)	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа

Variation D.

ДАТА:DD.MM.GG СМЕТНАЯ СТИМОСТЬ
ТЕМА: < ШИФР >(3) < НАИМЕНОВАНИЕ ОТДЕЛА >
ФИНАНСИРОВАНИЕ < ВИД ФИНАНСИРОВАНИЯ > (4) руб. (5)

	(6) ЗАРАБОТНАЯ ПЛАТА	ОТЧИСЛЕНИЯ НА СОЦСТРАХ (7)	НАКЛАДНЫЕ РАСХОДЫ (8)	КОМАНДИРОВКИ (9)	УСЛУГИ СТОРОН.ОРГ. (10)	ОПЛАТА ЭВМ (11)	НЕШТАТНАЯ ЗАРПЛАТА (12)	ПРОЧИЕ ЗАТРАТЫ (13)	ИТОГО (14)
1 КВАРТАЛ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
2 КВАРТАЛ (15)	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
3 КВАРТАЛ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
4 КВАРТАЛ	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа
ИТОГО ЗА ГОД (16)	ааааааа	ааааааа	ааааааа	ааааааа	ааааааа	ааааа	ааааааа	ааааааа	ааааааа

Key: Variations C and D.

1. Estimated cost
2. Department name
3. Theme <code>
4. Financing <type of financing>
5. Rubles
6. Wages
7. Social insurance deductions
8. Invoice expenditures
9. Out-of-town jobs
10. Services of extraneous organs
11. Computer charge
12. Supernumerary wages
13. Miscellaneous expenditures
14. Total
15. Quarter
16. Total for year

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Chapter 3. MANAGEMENT OF CLASSIFICATION SYSTEMS AND DMS

UDC 025.4:002:681.3.06

EXPERIENCE OF CREATION AND INTRODUCTION OF UNIFIED DOCUMENTATION AND CLASSIFICATION SYSTEMS IN SECTORIAL AUTOMATED CONTROL SYSTEM OF UkSSR MINISTRY OF EDUCATION

[Article by Candidates of Technical Sciences V.Ye. Bykov, M.Ya. Pleskach, and V.A. Burikov from the Kiev State Pedagogical Institute imeni A.M. Gorkiy]

Using unified documentation systems [UDS] and a unionwide classification system for technical and economic information [OKTEI] is a necessary condition of the effective functioning of an MIS in the current stage of the development and improvement of the management of a sector.

The main direction in the development of works in USD and an OKTEI is their orientation toward software for automating document turnover and the unity of an information base for the MIS by the method of implementing a standard processing technology and integrated information storage for purposes of improving the accounting, planning, and management system. The importance of these operations has increased significantly under conditions of the reform of the general education school and the creation of an integrated sectoral software based on charts of institutions of the education system.

The currently accepted structure of documents and document turnover in the sector does not satisfy the main prinicples of integrated software. Despite the successful use of a number of unified documentation systems such as the Unifed System for the Organization and Distribution of Documents [USORD], Unifed System for Report and Statistical Documentation [USOSD], Unifed System of Planning Documentation [USPD], and others, there are difficulties related to processing information, particularly at the oblast and rayon administrative levels. The existing approaches to designing and developing unified forms of documents has, to a significant degree, been determined by the tasks for which the forms have been designed, as a consequence of which a large number of local classification systems have been created.

Such an approach when developing unified documentation facilitates the doubling of information and complicates the technology of creating unified integrated software and the accomplishement of the task of ensuring the accuracy of information.

It is expedient to create a unified document-chart of each institution in the educational system in order to solve the problems related to developing unified documentation in the UkSSR Ministry of Education system more completely. Such a chart will contain necessary information about the process and results of the activity of the institution.

At present, working on charting educational objects has been widely developed. A document called a "day general education school chart" has been developed, and it has been tested in a data base on the Kiev oblast. Results of the experiment have confirmed the correctness of the direction selected for unifying documentation. Works on charting two educational objects are now underway.

Charting as the basis of unifying documentation requires painstaking methodological and organizational preparation.

Designing unified forms of "organization chart"-type documents by existing methods without sufficient automation significantly reduces the quality of the documents designed and increases their development time. This is because the process of developing charts has a multiple-version nature, i.e., each end (matched) document form is preceded by the development of several versions.

An automated document design system [ASPD] has been developed at the Main Computer Center of the UkSSR Ministry of Education in order to accelerate design operations on charting and standardizing these decisions.

In a wider plan, the ASPD may be viewed as a system providing the design and generation of input documents (a graphic model of a document) that is intended for matching, corroboration, and subsequent use in design documentation and output documents as the result of accomplishing a task in a sectoral automated control system [SACS].

The essence of this system is that document models that are described using a formalized language and a thesaurus-type file that includes the designation of the indicators and word combinations contained in the documents being designed are input into program modules.

These developments have been implemented in a Palma DBMS-operating system environment in the language PL/1 using algorithms for obtaining an optimal document form [1].

Orientation for this type of document requires a reexamination of existing approaches to creating and maintaining sectoral technical and economic information classification systems. Use of the Unionwide Classification System of Technical and Economic Information [OKTESP], the System of Definitions of Objects of the Administrative Territorial Division of the USSR and Union Republics as Well as Population Centers [SOATO], the System of Definitions of Measurement Units Used in Management Automation Systems [SOYeI), etc., is a necessary condition when constructing charts.

Unionwide classification sysems are an important component of a unified sectoral information language. Creating a system for mainting an OKTEI has provided the informational compatibility of the organizational levels of the SACS with the oblast management subsystems and the union level of the SACS of the UkSSR Ministry of Education.

The classification system is maintained with the help of a sectoral automated system for maintaining the unionwide and sectoral classification systems [OASVOK TEI]. Its users are the structural subdivisions of the UkSSR Ministry of Education, oblast and rayon national education dpeartments, higher and secondary pedagogical educational institutions, scientific research organizations, and branch information computer centers of the sector.

The main features of the OASVOK TEI are as follows: maintaining files and test copies of the classification systems used in the sector; providing users with information about the classification systems and informing them regularly about changes in the classification systems; and collection, appraisal, and direction of proposals for improving the classification systems to the head organization concerned with maintaining such systems in the UkSSR Ministry of Education.

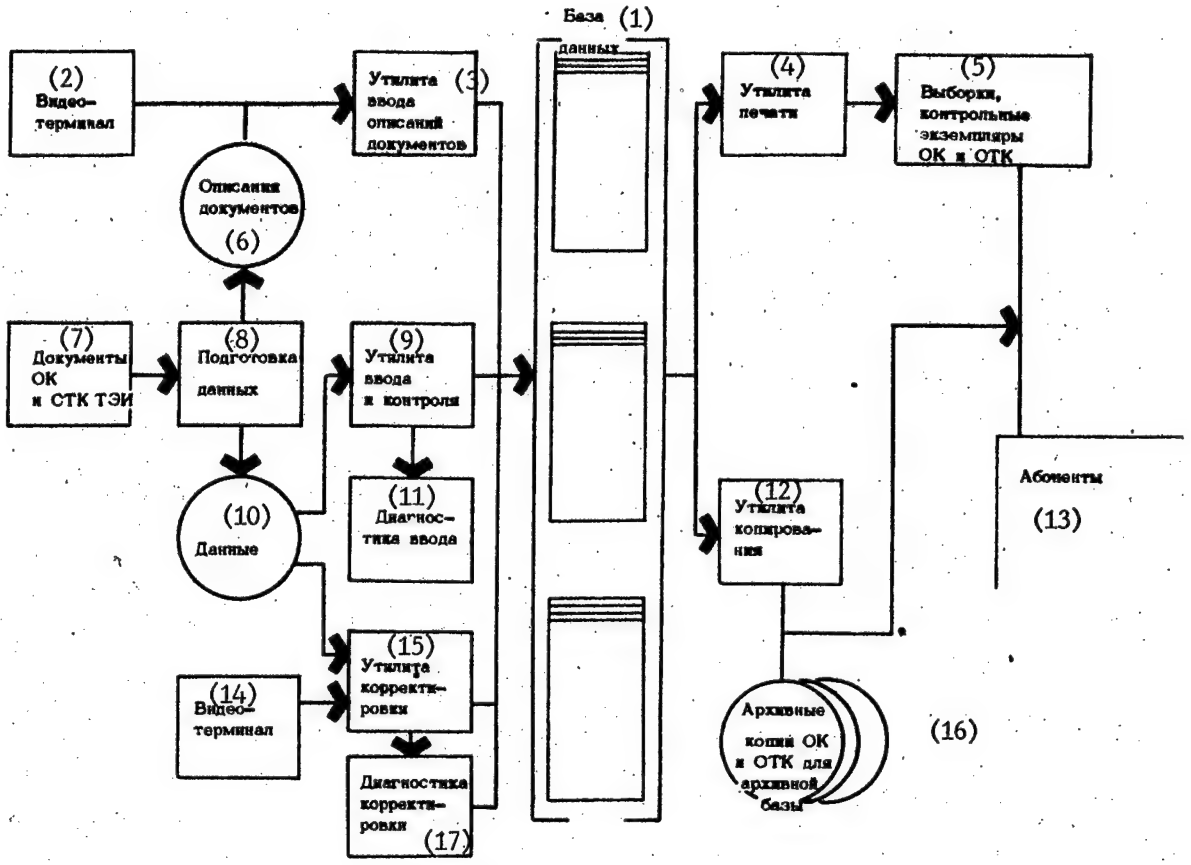
Twenty-five classification systems are used in the SACS of the UkSSR Ministry of Education. These include the following unionwide classification systems: enterprises and organizations, specialities according to education, information according to cohorts, administrative documentation, definitions of objects of the administrative territorial division, and definitions of units of measurement used in the management automation systems. A number of sectoral classification systems are used, including those of ministries and departments, correspondents, organizers and executors, suppliers, etc.

Three aspects of maintaining the classification systems may be singled out: methodological, software engineering, and informational.

The methodological aspect involves analyzing the subject area and working out the classification lists. A list of possible unionwide classification systems is specified as a result of this analysis. An expert appraisal is made for the completeness of the classification lists, the appropriateness of using local coding systems, and the flexibility of the classification systems created.

The software engineering aspect of maintaining the classification systems consists of using specified operating means, applications packages, and program modules to create, actualize, and copy the classification system files. The Palma DBMS, which operates under control of the OS YeS 6.1 operating system has been selected as the operating environment of the ASBOK TEI. This is a relational-type DBMS with a set of software that makes it possible to implement all functions with respect to creating, updating, sorting, and printing information files on computer carriers. The standard DBMS has been expanded significantly in the GVTs of the UkSSR Ministry of Education so as to provide a unified technology for processing all online information. Computer files of the unionwide and sectoral classification systems are implemented and maintained in the framework of this production scheme.

Creation of the files has provided for the transfer of data from a paper carrier to magnetic tape, and a description of the structure of this file is



Key:

1. Data base
2. Video terminal
3. Utility for inputting descriptions of documents
4. Print utility
5. Samples and test copies of OK and OKT
6. Descriptions of documents
7. OK and OK TEI documents
8. Data preparation
9. Input and checking utility
10. Data
11. Diagnosis of input
12. Copy utility
13. Users
14. Video terminal
15. Correction utility
16. Archival copies of the OK and OKT for the archive base
17. Diagnosis of correction

prepared simultaneously on magnetic tape. Thus, the given classification systems and their description, i.e., data about the data (metadata), are on a magnetic carrier. By means of the OS YeS, this information is rewritten into a working library set where it is verified and corrected. A utility for inputting descriptions of the documents first inputs metadata from this set and then

information of the classification system itself. Implemented in the process is program checking for correspondence of the formats of the input data elements and the structure of their aggregates (records, documents) with this metadata. In the past, this checking entailed the writing of the data by a utility in a specified section of the library, its being corrected there, and its being input again.

The classification system files in the data base are corrected using DBMS and internal developments of the GVTs of the UkSSR Ministry of Education that make it possible to introduce all changes in the data base files from the display screen and subsequently compressing the information and making dictionaries that help provide direct access to the information. Notification of changes is the basis for making the correction.

The classification system files are stored in a separate section of the data base that is apart from the normative and reference information.

A specially developed printing utility makes it possible to obtain test copies of the classification systems, which are convenient for the user. A copy utility makes it possible to copy classification system files onto magnetic carriers both from data base archives and for supplying users.

The Figure presents a flow chart of the production process of the OASVOK TEI.

The information aspect of the process of maintaining the classification systems consists of orienting the maintenance system to the distributed data bank written into its circuits. In this case, developing the interaction of the GVTs of the UkSSR Ministry of Education with branches of the information computer centers [IVTs] based on mutually compatible hardware and software is important.

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CSO 1863/340

UDC 007.52:512.93

INTELLIGENT ROBOT FOR QUALITY EVALUATION AND FEED OF ASSIGNED POLISHED SHEETS FOR HEAT EXCHANGER PRODUCTION

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZANSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian No 5, Sep-Oct 85 (manuscript received 13 Dec 84) pp 123-130

[Article by R. A. Aliyev and A. E. Tserkovnyy, Sumgait Azerbaydzhan Petroleum Technology Technical Institute imeni M. Azizbekov]

[Abstract] A description is given of the decision-making procedures in an intelligent robot for flexible automated production complexes which can evaluate and sort aluminum sheets for the production of heat exchangers. The flexible automated production system considered carries out primary processing of aluminum sheets, cold pressing and formation of heat exchanger ducts. Much waste is due to subjective visual evaluation of the aluminum sheets by humans. The robot receives data on the state of the sheets from a tactile sensor and makes decisions which are executed by a microprocessor-controlled manipulator-sorter. Decision-making is based on fuzzy-logic inference procedures based on the input parameters for bending and, to a lesser extent, on temperature after heat-treatment hardening. The data is treated as fuzzy sets which are transformed into a linguistic "quality" variable allowing grading of the sheets into a series of approximate classes. The grading data enters the manipulator-sorter and determines its angle of rotation which has three levels indicating three levels of a linguistic "quality" variable showing rejected, reprocessable and acceptable sheeting. It is possible to use the manipulator-sorter in numerical control mode. A fragment of a control algorithm is given. A method of the described type was realized at the automated heat exchanger production unit of the Sumgait Aluminum Plant. Figures 1; references 2: 1 Russian, 1 Western.

12497/12947
CSO: 1863/175

UDC 658.012.011.56.001

ARCHITECTURE OF COMPUTER-AIDED INTEGRATED CIRCUIT DESIGN SYSTEM APPLICATIONS SOFTWARE AND HARDWARE

Tbilisi SOOBSHCHENIYA AKADEMIKII NAUK GRUZINSKOY SSR in Russian Vol 120 No 1, Oct 85 (manuscript received 6 Sep 85) pp 153-156

[Article by R. Sh. Gogsadze, N. I. Dzhibladze, N. I, Kakhishvili, K. Yu. Kotlyarenko, D. K. Surguladze, and Z. K. Shavishvili]

[Abstract] This study describes the development of a computer-aided design system for automating design procedures in creating integrated microcircuits. The proposed system is a three-level computer complex in which the lowest level performs the most labor-intensive operations, while the top level executes the fundamental computational procedures. The hardware and software architecture represent a systems approach to CAD design. Implementation of the system speeds design and reduces costs, in addition to improving quality by reducing the probability of design error. Figures 1, references: 3 Russian.

6900/12947
CSO: 1863/275

UDC 681.3

MULTIMICROPROCESSOR SYSTEM FOR MEDIAN FILTERING OF IMAGES WITH BITWISE MEDIAN SEARCH

Novosibirsk AVTOMETRIYA in Russian No 1, Jan-Feb 86 (manuscript received 13 Sep 84) pp 53-56

[Article by K. I. Kucherenko and Ye. F. Ochin]

[Abstract] A histogram algorithm is proposed for median filtering of images with bitwise median search, in which the high-order bits are identified, followed by the low-order bits. The algorithm is based on forming exact samples in accordance with the local histogram and rough samples of a second, rough, histogram. The medians are sought by determining the interval of the exact samples in the histogram in which the median is located, and then determining the low-order bits of the median from the exact samples of the histogram. A multimicroprocessor system is described that implements the algorithm. The algorithm is fast, and the E criterion, defined as the number of pixels processed by one processor per unit of time, is good. Figures 1, tables 2, references 6: 1 Russian, 5 Western.

6900/12947
CSO: 1863/273

UDC 681.351.3:519.6

PHASE DIAGRAM INFORMATION SYSTEM ALGORITHMS AND SOFTWARE

Novosibirsk AVTOMETRIYA in Russian No 1, Jan-Feb 86 (manuscript received 2 Jul 85) pp 47-53

[Article by Yu. P. Drobyshev and S. V. Zykin]

[Abstract] The software and algorithms employed by an information system that manages a data base of experimental material on phase diagrams of multicomponent compounds are investigated. The system is used to store and process graphic phase diagram information, phase diagram projections in the temperature and pressure variation space, and necessary phase diagram reference information. The software is designed to produce a two-dimensional cross-section of the phase diagram in the form of a graph output to a graph plotter, and likewise for P-T projections, as well as to identify the region code from a fixed point on the phase diagram, to find the limits of existence of a region from a fixed point and the direction to the phase diagram, to find surface points on the phase diagram for lines on the P-T projection, to output a table of non-invariant points on the phase diagram, to output all codes on the phase diagram and P-T projections, and to provide reference information on documents. The stored information is independent of the software, the request language is simple and nonredundant, and the applications programmer does not need to know the physical realization of the stored data. Figures 2, references 8: 3 Russian, 4 Western.

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AUTOMATED OPTICAL INTERFEROGRAM PROCESSING SYSTEM

Novosibirsk AVTOMETRIYA in Russian No 1, Jan-Feb 86 (manuscript received 12 Jan 84) pp 57-61

[Article by N. S. Vernigorov, A. V. Pugovkin, M. G. Sedunov and L. Ya. Serebrennikov]

[Abstract] An automated interferogram processing system for measuring the spatial position and relative phase difference of radio signals to within approximately 1% is described. The functional diagram and operating principle of the system are described. The phase measurement error of the output TV signal is analyzed. The use of the system for phase measurements in an acousto-optical phase meter-frequency meter is described. The system can be used for quick processing of optical interferograms, e.g., for measuring optical spectrum offset and refraction index profiles. Figures 6, references 5 (Russian).

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USE OF TWO-LEVEL NEWTON ALGORITHM IN MACHINE ANALYSIS OF ELECTRONIC CIRCUITS

Novosibirsk AVTOMETRIYA in Russian No 1, Jan-Feb 86 (manuscript received 19 Apr 84) pp 65-70

[Article by V. V. Yefimenko and Yu. A. Stukalin]

[Abstract] A circuit partitioning method is formulated for the node potential circuit analysis method. A two-level Newton interative process is described in which a single subcircuit is isolated from the circuit in question, and the circuit is described in a node voltage basis by a system of first-order nonlinear differential equations. The use of two-level Newton iterations in machine analysis is found to require less machine memory and speed the circuit analysis as compared with single-level iterations. The two-level Newton algorithm makes it possible to exploit latency properties in analyzing large-scale integrated circuits, thus reducing the analysis time for some classes of circuits by approximately an order of magnitude. The computational resources needed for circuits with little latency (such as fully connected circuits with feedback) can be reduced by using circuit elements with short time constants and separate subcircuits, integrating the subcircuit equations with different integration steps. In contrast to the traditional approach, the Newton algorithm makes it possible to exploit information about the nature of the nonlinearity of the subcircuit equation in order to solve it more rapidly. References 12: 10 Russian, 2 Western.

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DATA COMPRESSION IN STATISTICAL INFORMATION TELEPROCESSING SYSTEM

Moscow VESTNIK STATISTIKI in Russian No 5, May 86 pp 55-57

[Article by S. Shulgin, department head, and G. Lades, senior programming engineer, RO Belmashinform, BSSR Central Statistical Administration]

[Text] The problems of statistical information acquisition and processing in the automated statwide statistical system (ASGS) are being solved by the hardware and software of the Statistical Information Teleprocessing System (STOSI).

One of the basic goals in development of STOSI is acceleration of information exchange between different levels of the ASGS on the basis of integrated automation of statistical data acquisition, transmission, processing and output. This problem becomes ever more timely, since the volume of information circulating through the communication channels that service it is increasing considerably as th ASGS is developed. In this regard, the systems that support information exchange are faced with problems of increasing the utilization factor of communication channels, computers, data transmission equipment and terminal equipment. These problems are interrelated and the main method of solving them (software is intended) is to reduce the redundancy of information to be transmitted.

A decrease of the redundancy of data is achieved by those conversions which reduce the volume, but do not distort the meaning of information. Statistical data compression software, used in transfer of files in the STOSI system, make these conversions. The compression devices are realized by a number of Kompander programs, developed in Assembler language of the YeS operating system. The name of the complex reflects its functional designation: compressor-expander. The programs of the complex are divided into two groups:

1) a compressor that determines the capabilities and effectiveness of compression for each specific block and that makes the compressing conversions of the information entering the network;

2) an expander, which brings the information coming from the network to its initial form.

The computer network of ASGS is oriented toward the use of telephone and telegraph communication channels, the speed of which, compared to high-speed computers, is low. For comparison: the throughput of a telephone communication channel is 4,800 bits/s, that of a telegraph channel is 600 bits/s and the speed of the YeS-1036 is 600,000 ops. This difference permits one to implement rather complicated

algorithms for analysis of information and compression in the online mode, since the Kompander operates in the main memory of the computer. The maximum volume of main memory to be used is 15 Kbytes.

From the viewpoint of the program complex, the information circulating in the network is an arbitrary set of symbols of the internal representation of the computer; therefore, only methods that do not take into account information semantics are used.

Let us present an example of the simplest of the compression methods to be used--the method of extinguishing repetitions. It requires introduction of a service symbol (X as an example) into the intial text.

Let the initial text contain a segment of the following type:
aaaaaaavsmmmmmaaaaa124nnn.

Prepared for transmission to the channel, it then assumes the form:
×7avs×5m×5a124nnn.

The essence of the method includes replacement of a chain of repeating symbols by three symbols: service, modifier of length and a symbol that formed the chain.

The need for complete analysis of the text to be compressed is obvious from this example. In fact, the initial information can include any symbols, but only a symbol which is not in the given text can be selected as the service symbol, otherwise the text will be incorrectly restored at the receiving end. If the text contained all possible symbols of the computer code, the given method cannot be used. Moreover, there is a limit of the applicability of the method: let the initial chain have length L, word length of symbols r and word length of modifier of length r_1. The method then produces a compressing effect, beginning at $L = \left(\frac{2r + r_1}{r}\right)$; the expression in the parentheses is rounded off to the larger value.

The limit of applicability exists for each method of compression. Based on this, the Kompander determines the most effective compression method (or composite of methods) for a given set of symbols. To do this by program, the following parameters are determined: the volume of text, the probability that symbols will be encountered in the text and the nature of distribution of symbols.

Since the information coming into the network is formulated in the form of packets, it is logical to assume that the unit of compression is the packet. The maximum length of the packet is 119 bytes (the information part) for STOSI.

Let us determine the time t, which is saved upon transmission of a compressed block:

$$t = \frac{8(L_I + L_S)}{V_1} \cdot N - t_S,$$

where L_I is the length of the information part of the packet (bytes), L_S is the length of the service part of the packet (bytes), V_1 is the speed of the channel (bits/s), t_S is the time expended on compression and N is the number of packets of the block to be transmitted.

The scalar multiplier 8 appears because the word length is L_I, L_S bytes and V_1 is bits/s.

Let s determine

$$t_S = \frac{W_1 + L_I \cdot W_2 \cdot N - W_3(N - N_2)}{V_2},$$

where W_1 is the number of operations to call the compression software, W_2 is the average number of operations performed on one byte of the packet, N_2 is the number of packets of the compressed block, W_3 is the number of operations of formulation of the packet entering the network and V_2 is the speed of the computer.

A check of the operating efficiency of Kompander, made during experimental operation, showed that the speed of file transmission is increased an average of twofold for real STOSI files.

Implementation of more powerful methods of compression (including Huffman code, the optimality of which has been proved theoretically from the viewpoing of reduction of redundancy) has been proposed in future development of the complex, which permits one to reduce the redundancy of information to a minimum. The preliminary estimate of the effect of using Kompander is 2-1/3 of the initial volume of information. This is typical for standard files, blocks of which contain alphanumeric statistical information.

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QUASISPLITTING METHOD AND APPLICATION FOR DESIGN OF AUTOMATED CONTROL SYSTEM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286 No 2, 1986 (manuscript received 3 Jun 85) pp 311-315

[Article by S. V. Yemelyanov, member of Academy of Sciences USSR, S. K. Korovin and I. G. Mamelov, All-Union Scientific Research Institute for Systems Research, Moscow]

[Abstract] In order to simplify the design of automated control systems with many dimensions, methods such as Lyapunov vector functions, integral manifolds, point mapping, aggregation and decomposition and singular perturbations are used in order to reduce the order of dimensionality of the dynamic systems. The quasisplitting method which is of the same general type is proposed and formally described. It can be applied to the controlled dynamic system before the control functions have been selected and when only limited information on control object characteristics is available. It has a clear geometric interpretation and facilitates study of control object characteristics. The method transforms the original dynamic system into an aggregate of linked dynamic systems with lower dimensionality such that there is only slight interaction between the dynamic systems. The original problem is thus reduced to that of a set of independent dynamic systems with lower dimensionality. The control system is then synthesized by selection from a class of permissible controls. References 12: 11 Russian, 1 Western.

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OPTIMAL FILTERING AND FIXED-DELAY SMOOTHING IN DISCRETE LINEAR SYSTEMS FOR THINNED SERIES OF POINTS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 1, Jan 86 (manuscript received 5 Feb 85) pp 65-74

[Article by R. T. Yakupov]

[Abstract] A new approach is developed for constructing optimal filtering and fixed-delay smoothing algorithms for the states of discrete linear dynamic systems. The approach is unique in that the state vector is estimated, and the gain matrix and estimation error covariation matrix are computed only at selected points in the time sequence, making it possible to relax the requirements for the capacity of the computing facilities used to produce the state estimates. The results can be used in designing information processing modules in dynamic systems. References 11: 6 Russian, 5 Western.

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